

Machinery



HARDINGE
ELMIRA, N.Y.

Machining Beryllium at Pioneer Astro Metallics Corp., Chicago, Ill., for guidance systems, disk and drum type computers, flight control systems, and atomic energy projects. HARDINGE machines are used exclusively to maintain super-precision tolerances.



REJUVENATING RED-HEADS

How to make an old Boringhead or Wheelhead Good as New

by Arthur Walsh
Manager, Parts Sales
The Heald Machine Company

There's only one way to make an old Red-Head good as new. Return it to its maker!

This statement is neither facetious nor exaggerated. Let's look at the facts.

A precision machine tool spindle, although basically simple in design, is one of the most carefully engineered and meticulously manufactured components of the entire machine. This is particularly true of Heald Red-Head Boringheads and Wheelheads. It has to be that way, for on the *spindle* depends the performance of the machine and the reputation of the Company.

When a Red-Head Wheelhead or Boringhead needs reconditioning, and you want it restored to original Red-Head precision, ship it back to us here in Worcester. For nobody knows as much about a product as the company which made it. And certainly no one else has so much at stake on its performance!

When a head comes back here we give it the full Red-Head treatment. This includes as *much* or as *little* as needs to be done to make it as good as new. Any or all of the following items may be replaced or reworked, depending on their condition — body, spindle, caps, slingers, pulleys, spacers, spring cages, bearings and miscellaneous parts. Only the finest Ultra-precision bearings made to Heald specifications are used — precision matched for exactly the right internal clearances, fits and preloads.

After final inspection and reassembly, every rebuilt Red-Head is run continuously on the test jack for eight hours to check for temperature rise, noise level and vibration. A head that passes all of our inspections and tests is in every respect as good as new.

The cost depends on the amount of work done and the parts reworked or replaced. But in all cases you get a head that carries the original Heald guarantee, at far less than the cost of a new head.

Several of our customers have adopted a policy of regularly-scheduled head rebuilding on a preventive-maintenance basis. This has worked out very well, as it keeps the amount of repairs to the minimum, assures fast return of the rebuilt heads and substantially reduces rebuilding costs.

It pays to come to Heald for all your Red-Head repairs.



Anti-Friction bearings for Heald Red-Heads are carefully selected and thoroughly inspected before assembly into any Red-Head—the same rigid specifications must be met for bearings to be used in either new or rebuilt heads.

It Pays to come to Heald

THE **HEALD** MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

DECEMBER 1961

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Editor CHARLES O. HERB

Managing Editor RAYMOND H. SPIOTTA

Associate Editors
FREEMAN C. DUSTON
HAROLD W. BREDIN
LAURENCE W. COLLINS, Jr.

Midwestern Editor CHARLES H. WICK
6712 Mark Court, Birmingham, Mich.

Materials Editor PAUL B. SCHUBERT

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Business Manager
ARNOLD F. CARUSO

Advertising Representatives
WALTER E. ROBINSON
W. R. WASHINGTON
93 Worth St., New York 13, N. Y.
ROBERT J. LICK
313 E. 216th St., Cleveland 23, Ohio
EMMET J. O'CONNELL
228 N. LaSalle St., Chicago 1, Ill.
NORMAN O. WYNKOOP, Jr.
44 Highland Ave., Detroit 3, Mich.
G. C. SMITH
1318 Beacon St., Brookline 46, Mass.
DON HARWAY & CO.
336 N. Central Ave., Glendale 3, Calif.
RICHARD E. HOIERMAN
9006 Capri Drive, Dallas 18, Tex.
FRED W. SMITH
P. O. Box 20060, Birmingham 16, Ala.

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MACHINERY

National House, West St., Brighton 1, England
and

Clifton House, 83-117 Euston Road
London, N.W. 1, England

France

LA MACHINE MODERNE
15, Rue Bleue, Paris-IX^e, France



Machinery

**THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION
IN THE MANUFACTURE OF METAL PRODUCTS**

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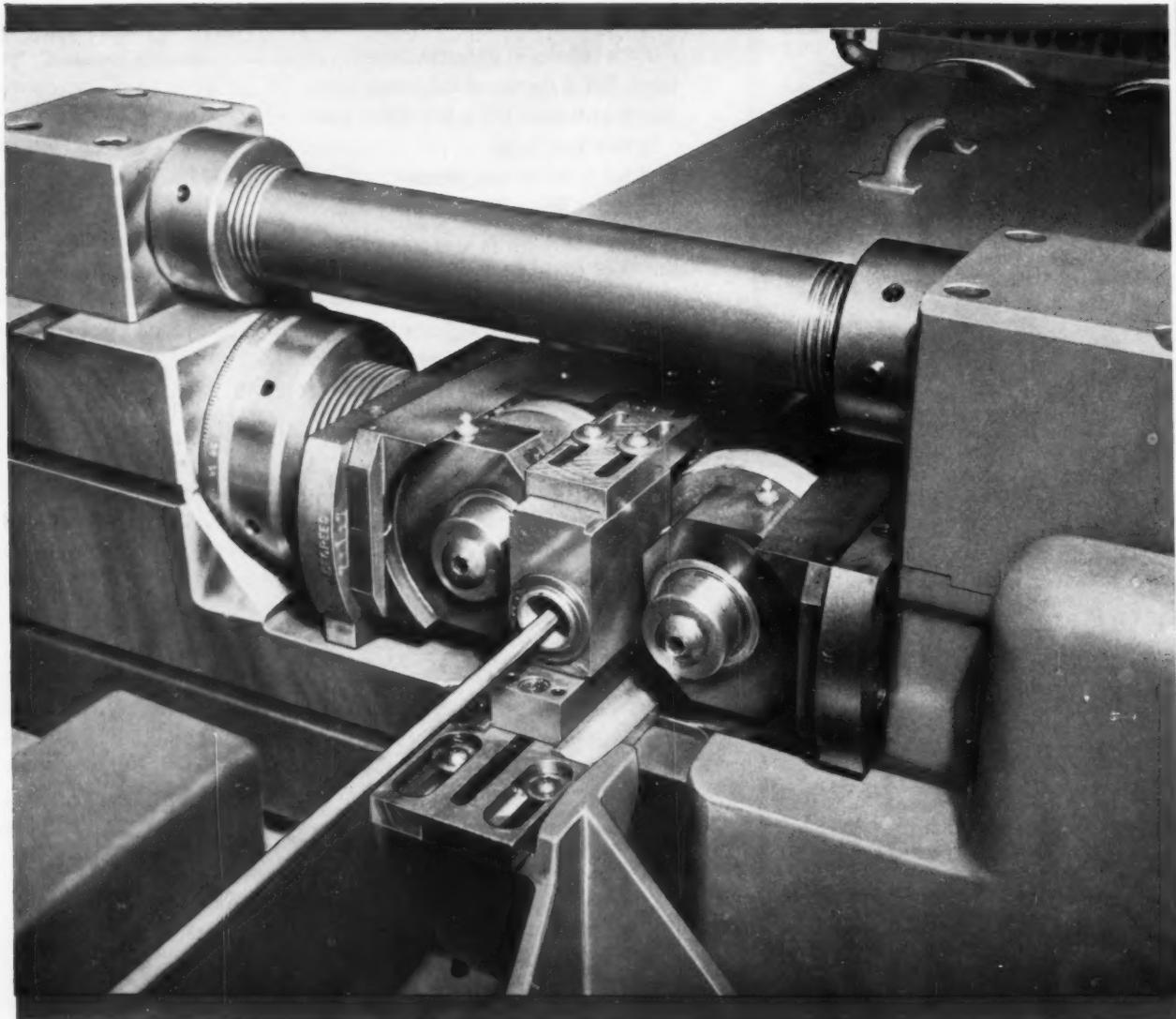
READERS' SERVICE CARD

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LAN•NU•ROL

THREAD ROLLING MACHINE

proved ideal for jobbing operation



To meet the requirements for a job-type high production threading operation, the Threaded Rod Co., Indianapolis, Indiana chose the small and low-cost, rugged and simple, cylindrical-die LAN-NU-ROL Thread Rolling and Forming Machine.

Officials of the Threaded Rod Co. report that the LAN-NU-ROL Machine has been operating perfectly with no breakdowns or any other trouble. Furthermore, roll life is excellent. For example, in the $\frac{1}{4}$ ", 20P size operation, 300,000 feet have been rolled on the original dies.

The LAN-NU-ROL'S design concept is formed on the basis of simplicity, rigidity and power; accuracy and versatility; low first-

cost, low die cost and uncomplicated set-up and service. The design is based on the two-roll principle in order to obtain the maximum spindle and bearing capacity. Also, the two-die principle minimizes die cost, set-up time and auxiliary equipment.

The LAN-NU-ROL is ideally suited for thru-feed rolling and a full complement of automatic feeding equipment is available for threading by this method. Although intended primarily for hand-loaded infeed rolling operations, automatic feeds can be supplied for infeed rolling wherever practical. The range of the LAN-NU-ROL is: Infeed—2" maximum diameter, 8 T.P.I.; Thrufeed—1" maximum diameter, 8 T.P.I.

625C

SPECIFICATIONS

Workpiece	Threaded Rods
Lengths	3 ft., 6 ft. and 12 ft.
Material	1018 cold rolled steel
Sizes being rolled	$\frac{1}{4}$ ", 20P— $\frac{5}{16}$ ", 18P— $\frac{3}{8}$ ", 16P— $\frac{1}{2}$ ", 13P— $\frac{5}{8}$ ", 11P— $\frac{3}{4}$ ", 10P— $\frac{7}{8}$ ", 9P—1", 8P



LANDIS Machine COMPANY WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

WHETHER YOU CHOOSE SHAPING



FELLOWS can offer both types of gear cutting machines

Fellows can supply Gear Shapers or Hobbing Machines for small lot or high volume production.

Either type can be equipped for automatic work handling. And, regardless of your choice, you'll be certain of maximum productivity, economy and consistently high accuracy.

FELLOWS GEAR SHAPERS, for cutting external and internal gears and other shapes, are built in a wide range of models. They range from a machine that will cut gears as small as 1/16-inch diameter and as fine as 200 pitch to one with a capacity of 120 inches and 2 diametral pitch.

FELLOWS-PFAUTER GEAR HOBBING MACHINES are now built in two sizes, the P 400 and the new P 630 (which has a capacity of 25 inches diameter 3 diametral pitch). **PFAUTER GEAR HOBBING MACHINES** are available in both larger and smaller sizes.

Why not ask a Fellows Representative for complete details? All Fellows Offices are at your service.

OR HOBBING...



GEAR HOBBER

FELLOWS-PFAUTER P 400:

Max. Work Diam. — 16";
Max. Face Width at 16" Diam. — 11";
Max. D.P. — 4;
Hob R.P.M. — 80-500.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U.S.A.

Branch Offices:

1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
6214 West Manchester Ave., Los Angeles 45

THE
PRECISION
LINE

Fellows

Gear Production Equipment



NOTICE

**to owners of thousands of CINCINNATI Centerless Grinding Machines
built between 1935 and 1945:**

Almost everything about your old CINCINNATI Centerless Grinder is obsolete! If you've done a good job of maintenance, it may be just as good as the day you bought it. But that's no longer good enough!

Your machine is obsolete because our new Centuramic makes available substantial increases in quality, accuracy, dependability—and important reductions in your costs. Here are the features that make the new Centuramic such an efficient producer:

MORE POWER, WEIGHT and RIGIDITY. Higher rates of stock removal are practical, at the same time holding far better tolerances on a production basis.

AUTOMATIC GRINDING WHEEL BALANCING. Without this feature you are probably spending more than 1 hour balancing the wheel. For good accurate work,

we now recommend it be done once each day; it only takes a few seconds with automatic balancing. You get better accuracy, longer wheel and diamond life and shorter grinding cycles.

ELECTRO-HYDRAULIC INFED. Feed rate and spark-out time are precisely the same for each part. Feed is against a positive stop rather than depending upon screw accuracy. Gives you consistent accuracy over the life of the machine.

OPERATOR EFFICIENCY. All working areas have been freed of obstructions. Controls are centralized (convenient rear handwheel control available). Extra steps, wasted time, awkward operator position—all have been eliminated to permit operators to produce more with less effort.



BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • ROLL •
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO



New CINCINNATI Centuramic
220-8 Centerless Grinding Machine.
Ask for Publication No. G-727-2-D.

FAST TAPER ADJUSTMENT. It's no longer necessary to re-true for proper grinding wheel contact on thru-feed, or to correct taper on infeed operations. You simply adjust at front of machine *without* disturbing alignment of workblade, guides and regulating wheel. Also reduces setup time. A great time saver!

MANY MORE COST-REDUCING FEATURES. Up to 20" wide grinding wheel—fewer passes, more economy. Hydraulic grinding wheel reciprocation for better finish on infeed jobs. Ball slides for high precision adjustment, minimum wear. Differential handwheel adjustment to .000050". Infinitely variable regulating wheel speeds. Power profile truing. Many others.

EXCEPTION. One feature of your old CINCINNATI Centerless is *not* obsolete—the Filmatic grinding

wheel spindle bearings. This is the only feature on which we've not been able to improve. These bearings require neither adjustment nor maintenance, they are highly accurate and apparently last forever. After 23 years, we've repaired only 0.1% of the many thousands in use!

If you care about costs and competition, you'll call in your Cincinnati representative right away. Ask him about the special trade-in proposition we're offering to make it easy to replace those old CINCINNATI Centerless Grinding Machines.

Remember, everything about your old CINCINNATI Centerless is obsolete. Everything, that is, except its Filmatic bearings and its great reputation.

CHUCKING • MICRO-CENTRIC • PRODUCTION LINES

CINCINNATI®
GRINDING MACHINE DIVISION

Now... a completely automatic



crankshaft grinder with indexing 'on the fly'

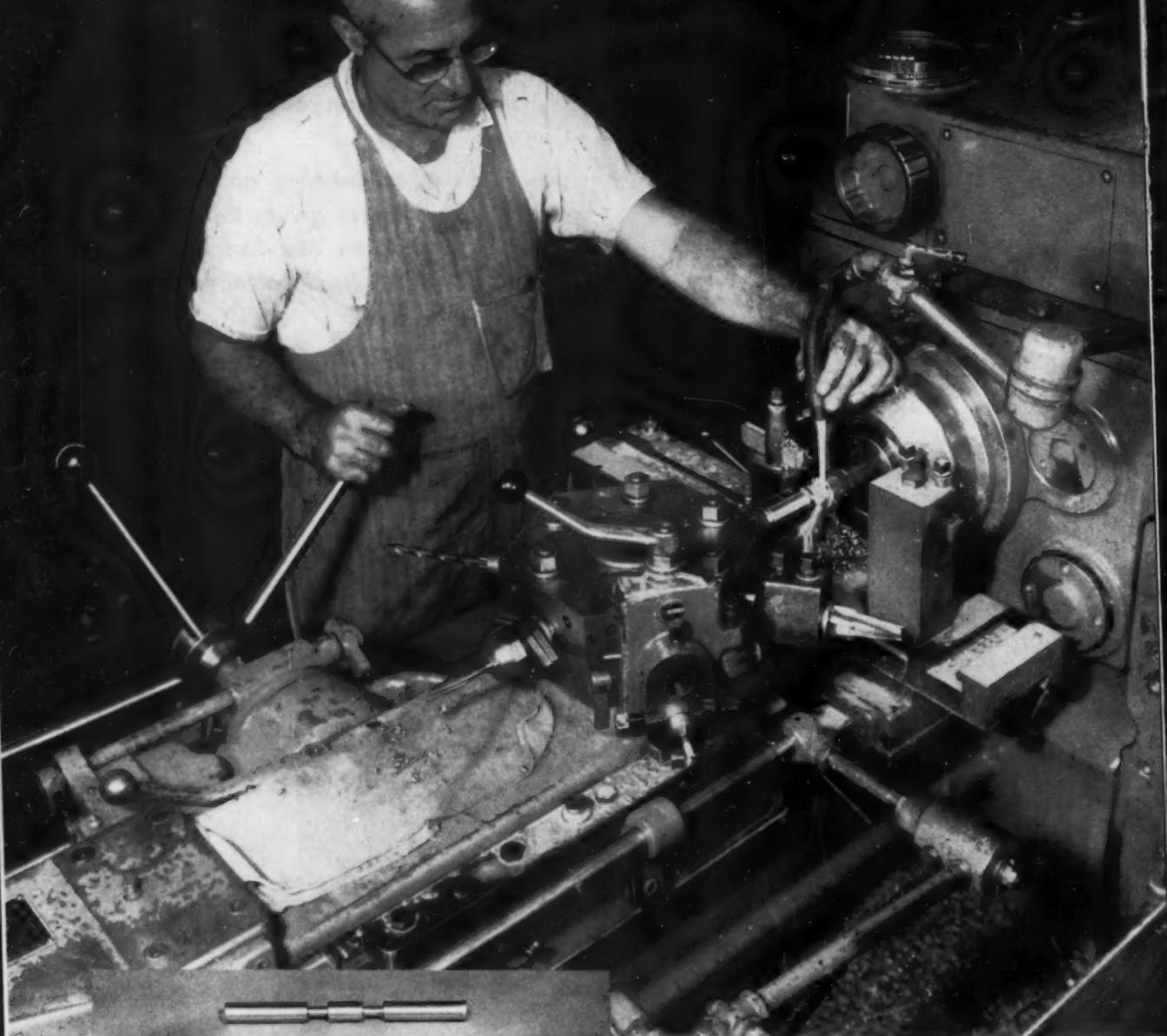
This new crankpin grinder can automatically grind, to close tolerances, more crankshafts per hour than you have ever produced before.

In addition to indexing on the fly, other automatic features giving this machine its higher production are Truform dressing, lateral locating, workrest advance, Micro-feed® and sizing.

LANDIS

LANDIS TOOL COMPANY, WAYNESBORO, PA.





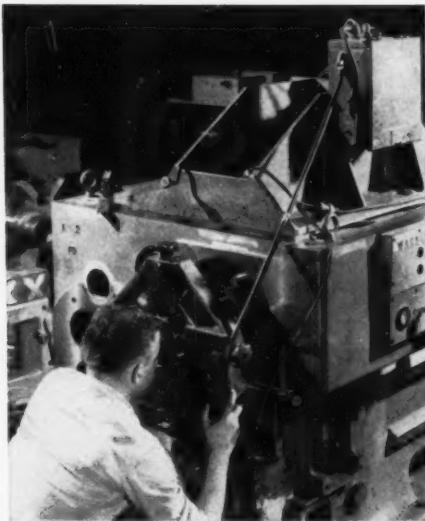
On the new No. 4 you can expect big reductions in handling time on jobs like these. Each machine in the Warner & Swasey line is individually designed for maximum efficiency and production in its own work range. As a result, operators like these machines for their easy handling and dependability in holding size.

At B-I-F INDUSTRIES, INC.

Providence, Rhode Island



.0005" tolerances and 32 micro-inch finishes held in tough metals



Permanent Accuracy—inherent in a Warner & Swasey turret lathe—begins with this optical method for precise alignment of the spindle with the bedways. Elsewhere in the shop, W/S machinists depend on master fixturing, precision finishing operations and careful fitting to assure lasting accuracy in Warner & Swasey turret lathes.

Holding size and finishes like these is simplified by the smooth running headstock, easy handling and dependable accuracy of the Warner & Swasey No. 4 Turret Lathe.

B-I-F INDUSTRIES has found that the built-in accuracy and the many new features of their No. 4 Warner & Swasey turret lathe have helped to eliminate the extra finishing operations formerly required on the work. In addition to better work finish, the vibrationless, all-clutch headstock has contributed to longer cutter life.

On small lots averaging 50 to 200 pieces—as well as on occasional lots of 3 or 4 pieces—their costs have been reduced because of the No. 4's higher speeds, greater horsepower, ease of setup and faster machine handling.

Why not check with your Warner & Swasey Field Engineer today for more information about the many new cost cutting features now available in our ram type turret lathes. Warner & Swasey Co., Cleveland 3, Ohio.

YOU CAN TURN IT BETTER, FASTER, FOR LESS
...WITH A WARNER & SWASEY



**For
non-pulsating flow...**

DE LAVAL



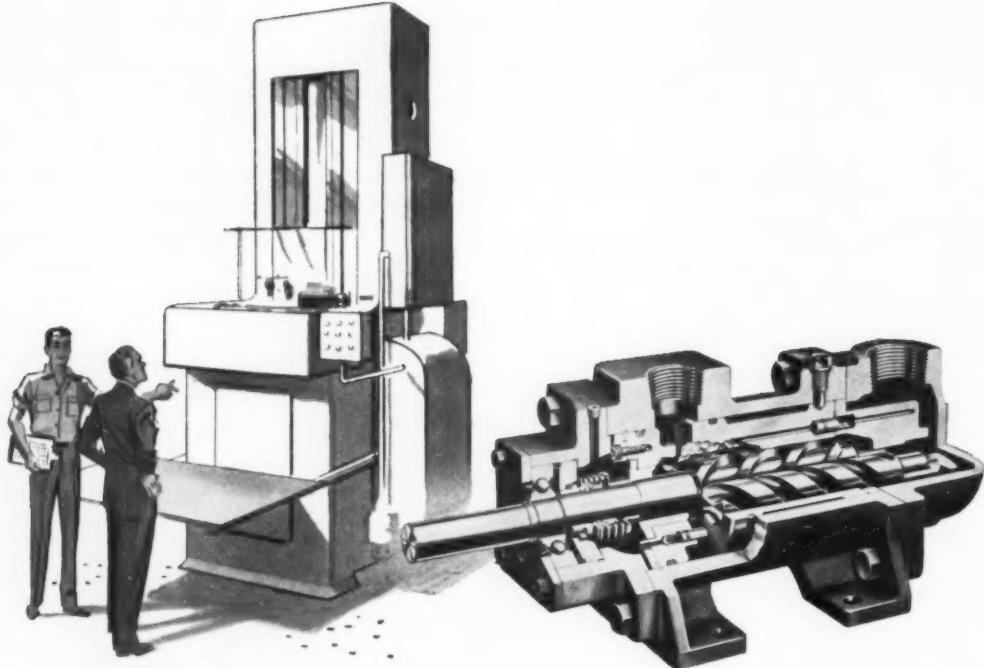
**power-hydraulic
pumps**

Fluid delivery is continuous; flow is pulsation-free. There are no intermittent strokes, no churning. Applications for which non-pulsating IMO pumps are ideally suited include many broaching operations, for example, where pulsation can cause irregularities in the finish.

Versatile IMO pumps deliver maximum performance in many varied power-hydraulic applications. Besides non-pulsating flow, IMO pumps offer quiet operation, high speed, wide capacity range, and reliability . . . even with fire-resistant fluids. Compact design saves expensive floor space. Installed cost is lower than for other types of pumps. IMO pumps cut maintenance, too . . . only three moving parts!

For application and performance data, selection information, dimension drawings and tables, write for Bulletin IM-3200.

De Laval Steam Turbine Company, Trenton 2, New Jersey.



IM-DL-108

DE LAVAL • 60 YEARS OF CREATIVITY AND QUALITY

CENTRIFUGAL PUMPS AND COMPRESSORS • TURBINES • IMO® ROTARY PUMPS AND HYDRAULIC MOTORS
MARINE PROPULSION AND AUXILIARY EQUIPMENT • HELICAL AND EPICYCLIC GEARS • TURBOCHARGERS

NO DOWN TIME FOR DISC CHANGE

in grinding all these jobs

Single Gardner disc specification grinds complete range of precision parts... saves time and costs for Ford Instrument Company



Gardner abrasive specialist developed this disc specification to grind all parts, eliminating down time for disc changing. Photos courtesy of Ford Instrument Co., Div. of Sperry Rand Corp.

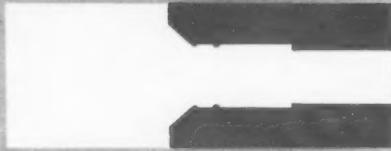
GARDNER
GARDNER MACHINE COMPANY, BELOIT, WISCONSIN

RIGHT NOW!

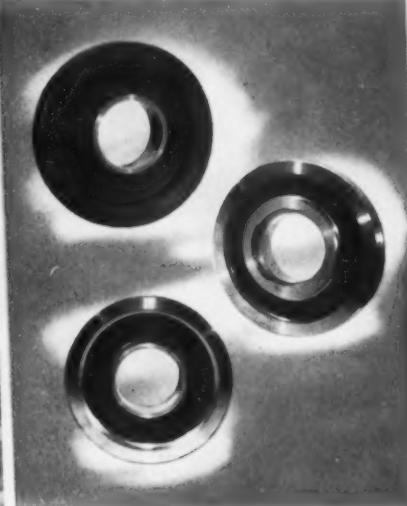
1 COMPRESSOR SHAFT

There are five operations involved in turning this part. Areas outlined in color in illustrations at right show metal removal in each operation. Handling this job on the Monarch Pathfinder Controlled Lathe results in 72% savings over the former method. Principally, these savings are obtained through the use of multiple cuts programmed to give an automatic cycle. A variety of tools and carbide grades are used in the turret to provide the best cutting action for each individual cut. Speeds and feeds are tape selected for each diameter change.

1. Rough turn excess stock (4 cuts).



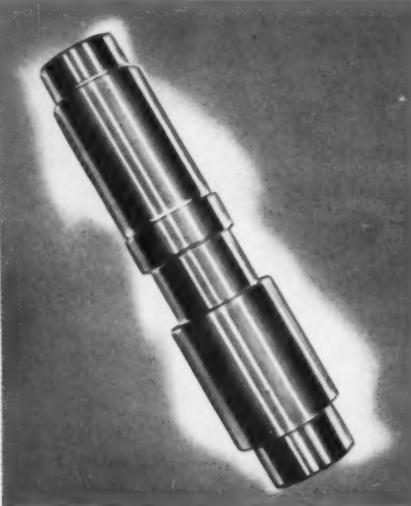
2. Dive to form flange (4 cuts).



2 GEAR BLANK

Material SAE-5150. Face Hub, Turn OD, Machine ID Web. Reverse Part, Turn Taper, Bore, Form Radius and Relief.

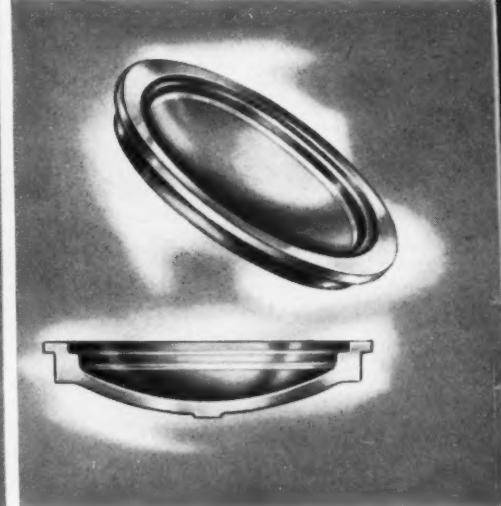
Method	Set-Up	Turn R.E.	Turn L.E.	Total 30 Parts	% Savings
Chucker	300 min.	3.5 min.	5.7 min.	576 min.	61%
N.C.	24 min.	3.5 min.	3.1 min.	222 min.	



3 PINION SHAFT

Material AISI-4145 Stock. Rough Turn, Undercut, Groove (2 diameters).

Method	Set-Up	Machining	Total 10 Parts	% Savings
Tracer	101 min.	13.9 min.	240 min.	68%
N.C.	12.5 min.	6.5 min.	77 min.	



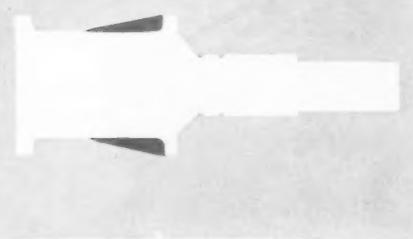
4 INJECTOR RING

Material 347 Stainless. Face and Turn OD, Bore ID Hub and Taper, Turn 18-inch Spherical Radius.

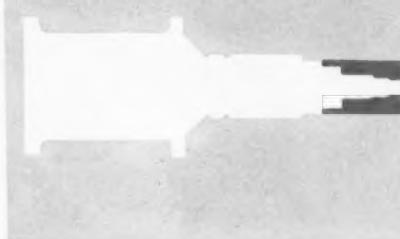
Method	Set-Up	Machining	Total 6 Parts	% Savings
Tracer	130 min.	290 min.	1870 min.	77%
N.C.	16 min.	70 min.	436 min.	

MONARCH PATHFINDER CONTROLLED LATHES ARE SUCCESSFULLY TURNING PRODUCTION PARTS AT CUSTOMERS' PLANTS WITH CONTINUOUS PATH NUMERICAL CONTROL

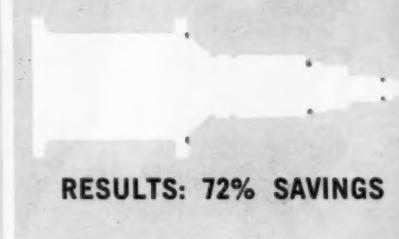
3. Remove stock in undercut-feed left.



4. Finish turn complete—stem end.



5. Form grooves.



RESULTS: 72% SAVINGS

Here are four examples of what can be done with Monarch Lathes "mated" with Pathfinder Numerical Controls. In each case a continuous smooth contour is produced by the numerical data which controls the tool path, distance and feed rate.

Why do we say "mated"? There are two important reasons why the machine control must be "mated" or "properly matched" by the machine tool builder to the specific requirements of the job. First, response of the control must be such that the machining capacity of the lathe is not limited. Second, accuracy of the lathe must be such that the full accuracy of the control is realized. Sounds academic, but these production examples prove it.

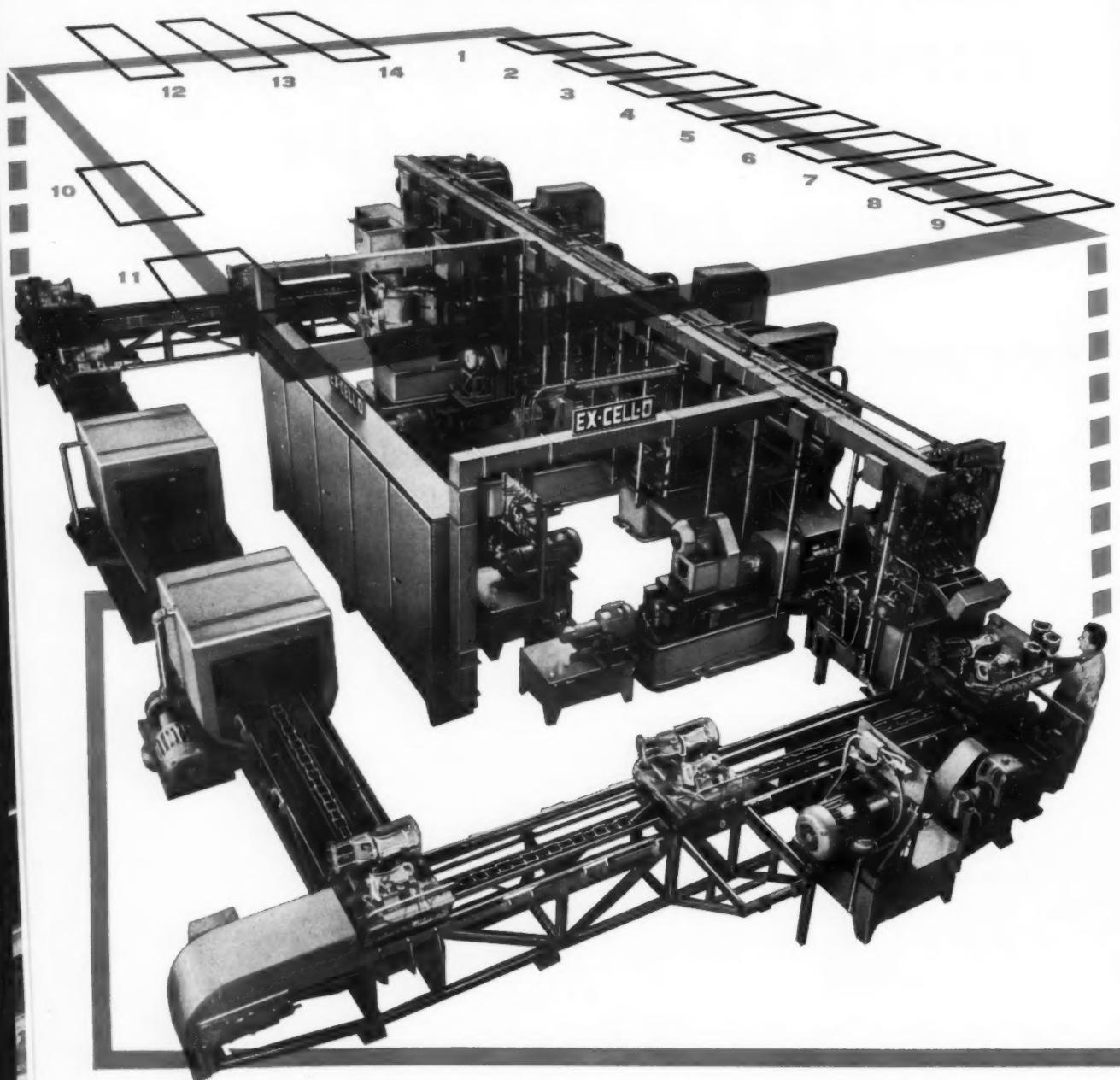
Monarch uses either one of several commercially available continuous path numerical controls on its lathes. These controls are "mated" at our factory to the following machines: Model 2013-16; Model 2516-20 Heavy Duty; Model 3220 Heavy Duty; and Model 4025 Heavy Duty.

When do you need a Numerically Controlled Lathe? Now is the time to investigate. Why not ask us to evaluate and review your turning requirements? Monarch's Numerical Control Department offers application planning, personnel training and field service. Write the MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.

*Ask about the Monarch Deferred Payment
and Tool Lease Plans*



Ex-Cell-O Transfer Machine bores,



1Unload, reload, load. Left and overhead: air-operated nut-runners.

2Left: rough bore, counterbore, chamfer O.D. Right: rough bore, turn, face.

3Left: idle. Right: drill two .265" holes vertically.

4Left: idle. Right: probe two holes drilled at Station 3. Core-drill and spot-face one hole vertically.

5Left: drill four 25/64" holes. Right: drill two 21/64" holes, combination drill and ream two .328" holes.

6Left: finish bore, counterbore and chamfer. Right: drill one 13/64" speedometer lock-screw hole vertically.

7Left: press in plain bushing. Right: finish-bore, chamfer hole roughed at Station 4.

8Left: finish bore bushing diameter, finish counterbore. Right: chamfer, form undercut, finish face.

9Left: idle. Right: tap three 1/4-20 UNC holes vertically.

10Jet-wash pallet.

11Blow-off pallet.

12, 13, 14Unassigned (for future operations).

counterbores, chamfers, faces, drills and taps aluminum transmission units faster than two per minute!

AUTOMATED for high-speed machining—Completely automatic rough-to-finish machining of aluminum transmission extensions is made possible by single-operator control system governing Ex-Cell-O pallet-return transfer system. Output is 124 parts per hour.

PALLETIZED for efficient parts handling—Designed to accept two different components, 18 pallets index in each cycle, carry each part through the machine twice. Parts are loaded, unloaded manually, using power clamp mechanism.

STANDARDIZED for lower initial cost, fast change-over—Spindles, CTW cutting tools, conveyors, torque actuators, worm reduction gearssets, drill bushings

and other components are all built by—and backed by—Ex-Cell-O divisions and subsidiaries.

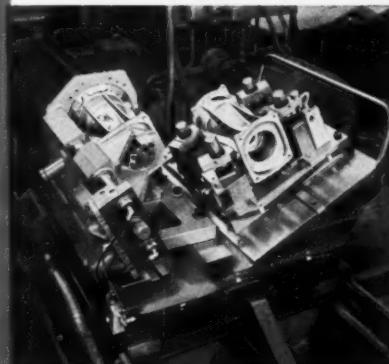
PRECISION-BUILT for unvarying accuracy—Extremely close tolerances are double-checked by inbuilt air-gage stations. Machine holds .0005-inch tolerances on finished bore diameters. Ultra-Precision Ex-Cell-O Spindles are used for all boring operations.

Do you have a large or small part that should be produced faster, more accurately? Your Ex-Cell-O Representative will be pleased to analyze your part or print and show you how an Ex-Cell-O Standard or Special can do the job for you.



Aluminum transmission parts vary in length and shape. Adjustable pallets accept either of parts shown above.

Below, two parts are shown on pallet, oriented 180° to each other. At load station, operator unloads finished part, shifts partially-machined part to empty fixture, loads unmachined casting on opposite side.



At bottom above, Ultra-Precision Spindle uses throw-away tooling. Vertical drill at rear of part at left is driven by Ex-Cell-O Hydraulic Power Unit.

61-28M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILLING BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

STEELWELD PRESS BRAKE CUTS FORMING COSTS

Fast Two-Step Operation Speeds
Trolley Duct Production



ELECTRIC trolley duct is turned out at a high rate on a Model K5-10 Steelweld Brake. The machine is fitted with removable bed and ram brackets to provide the width necessary to support two sets of dies. The front dies flange both sides of steel strips. The rear dies form the flanged strips into ducts. Thus, with each stroke of the ram, two operations are performed and a trolley duct completed. As many as 20 ducts can be produced per minute, which is the speed of the machine.

Two men normally work at the press, and each is provided with a set of control buttons. As a safety measure, two "run" buttons,

requiring both hands of the two men, must be depressed to operate the machine.

This machine has air-electric control which eliminates the need of any cross shafting at front for mechanical foot treadles. Air-electric control makes push-button operation possible and provides fast, positive clutch and brake action.

Write for free copy of catalog No. 2023A

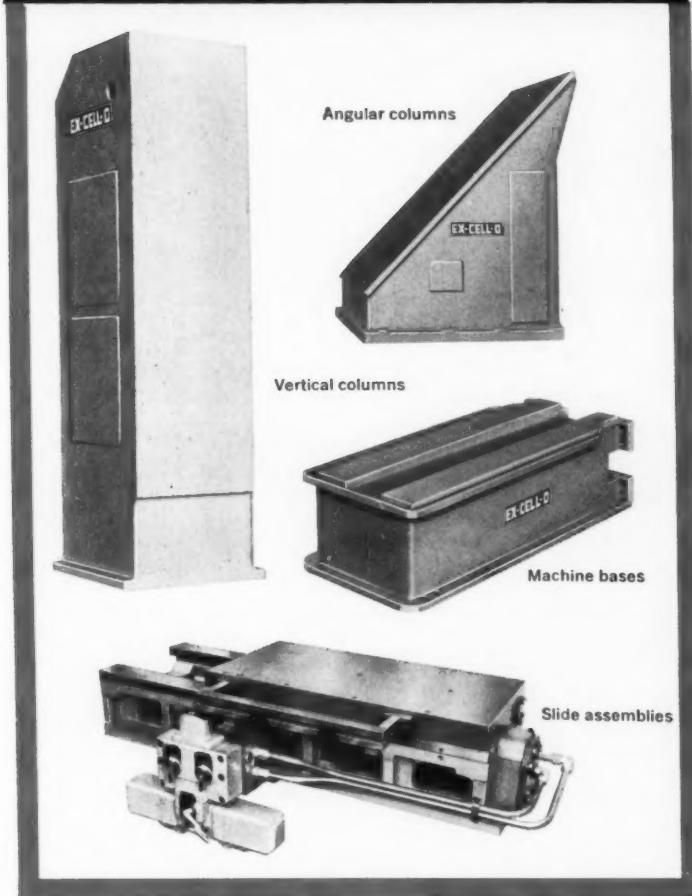
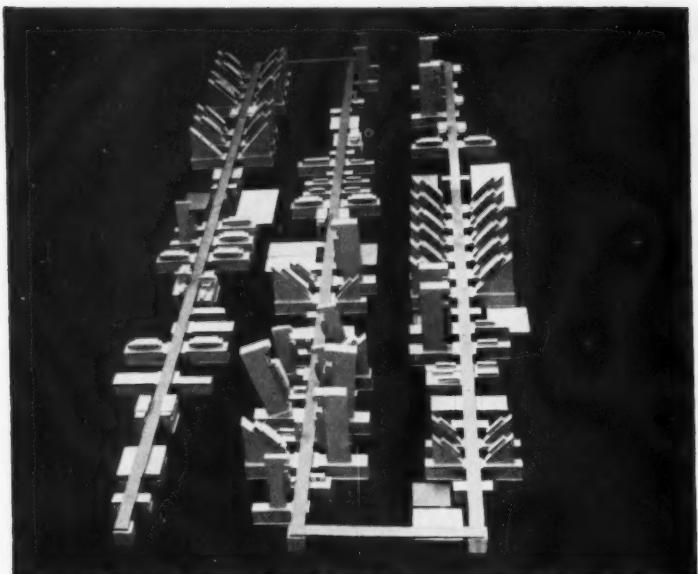
STEELWELD
Mechanical and Hydraulic
PRESS BRAKES



Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

- 5472 EAST 281 STREET • WICKLIFFE, OHIO

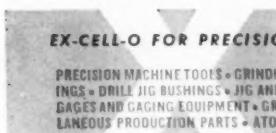
THE CLEVELAND CRANE & ENGINEERING COMPANY



For economy, productivity, flexibility ... **EX-CELL-O** **BUILDING** **BLOCK UNITS!**

- You get custom equipment, made from low-cost, standardized units.
- You can build simple one-way precision machines, or huge multi-station transfer machines.
- You can remove, relocate or add work stations to suit your production needs.
- You can arrange components for horizontal, angular, radial or vertical machining.
- You can partially or completely automate any sections.
- You can set up single or multiple functions—bore, counterbore, turn, drill, ream, face, chamfer and other operations.
- You can re-tool with standard Ex-Cell-O spindles, hydraulic power units and other accessories—and know all units will fit perfectly.
- You get faster delivery because standardization reduces engineering and build-up time.

If you're looking for manufacturing flexibility, look into Ex-Cell-O Building Blocks. Call your Ex-Cell-O Representative, or write for Bulletin 505911.



EX-CELL-O FOR PRECISION

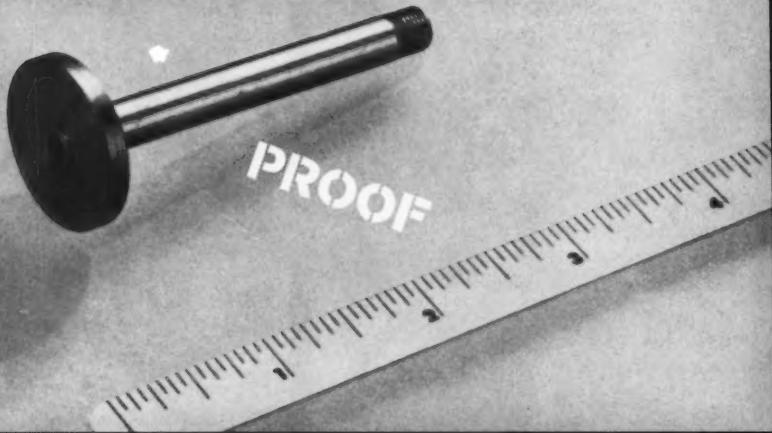
PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND CAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division



61-29M

reduce rejects on high speed automatics...



with *Carpenter* stainless machining bars

Not one reject on this critical part since changing to Carpenter Stainless No. 8 (Type 303)!

Specifications on this part called for a .1585/.1595" hole to be drilled to a depth of 2-11/16 inches through the shaft with eccentricity not exceeding .004 T.I.R. Finish of the hole could be no less than 63 micro inch. The lack of consistency in a competitive stainless Type 303 often caused such a high reject rate that entire lots had to be scrapped! With Carpenter Stainless No. 8 rejects have been completely eliminated.

What are your requirements? No matter how critical, the consistent uniformity of Carpenter Stainless Machining Bars will pay you dividends. For immediate delivery call your local Carpenter SERVICE-CENTER. The Carpenter Steel Company, Reading, Pa.

Carpenter steel



you can make it **consistently** better with Carpenter Stainless Machining Bars for Specialists

Let the work size, operations, finish or output change ...

Standard Ex-Cell-Os will meet your needs!



Double-end Model 752 (shown at left) finish-machines both sides of this torque converter stator in one cycle at a rate of 140 per hour. Standard tooling, spindles, and other components permit fast change-over from this job's boring, turning, facing, grooving and chamfering operations to any required single or multiple functions.

Close center-distances are held on this transmission pump cover, one of three different parts finished on a single-end Model 751 Precision Bore. Cross slide indexes during each cycle, and a common spindle bores the dowel holes. One or more Heavy Duty or Ultra-Precision Spindles can be used in place of the three Ex-Cell-O Square Body Spindles shown.

Modern Ex-Cell-Os represent over 30 years of specialization in Precision Boring Machines. Your Ex-Cell-O Representative has data on a wide variety of standard, special and building-block types to quickly provide optimum equipment utilization in your plant. Call him soon, or write direct for details.

61-16M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • COMTOM PROJECTORS • GAGES AND MFGNG EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN



1,000,000 blows a day into solid rock

Nickel alloy carburizing steels sustain powerful punch of heavy-duty drill.

Every working day this G-900 Tracdril* hammers its bit deep into solid rock. Connecting the drill motor and the bit is a string of steel which must take the tortuous impact of more than 25 blows per second without failing. To meet this stern requirement Chicago Pneumatic engineers specify nickel alloy carburizing steels for the most critical parts.

In the chuck end of the drill, where the punishment is most severe, carburized and hardened AISI 3312 (3.5% Ni, 1.5% Cr) is used. Parts

made of AISI 3312 withstand severe compressive loading and wear resistance, because under heat-treatment they develop a surface hardness of 60 Rc min. coupled with a core hardness of 35-40 Rc.

In the drill feed motor rotor and the rifle bar and striking bar of the drill AISI 4620 (1.8% Ni), provides excellent strength and toughness. To take high shock loads and heavy wear, these parts are carburized and hardened for a tough, impact-resistant core beneath a hard case. AISI 4620 provides minimum distortion during heat-treatment and at a hardness of 60 Rc can handle compressive loads of 200,000 psi.

AISI 3312 and 4620 are just two of many nickel alloy steels that handle rugged jobs in all sorts of heavy-duty equipment. They last longer, perform better, and can be fabricated at practical cost. If you'd like help with your problems in the selection of alloys, simply write to Inco describing them.

*T.M. Chicago Pneumatic Tool Co.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street  New York 5, N. Y.

INCO NICKEL
MAKES STEEL PERFORM
BETTER LONGER

MACHINERY, December, 1961

Ex-Cell-O Model 312 generates 21 surfaces per part!

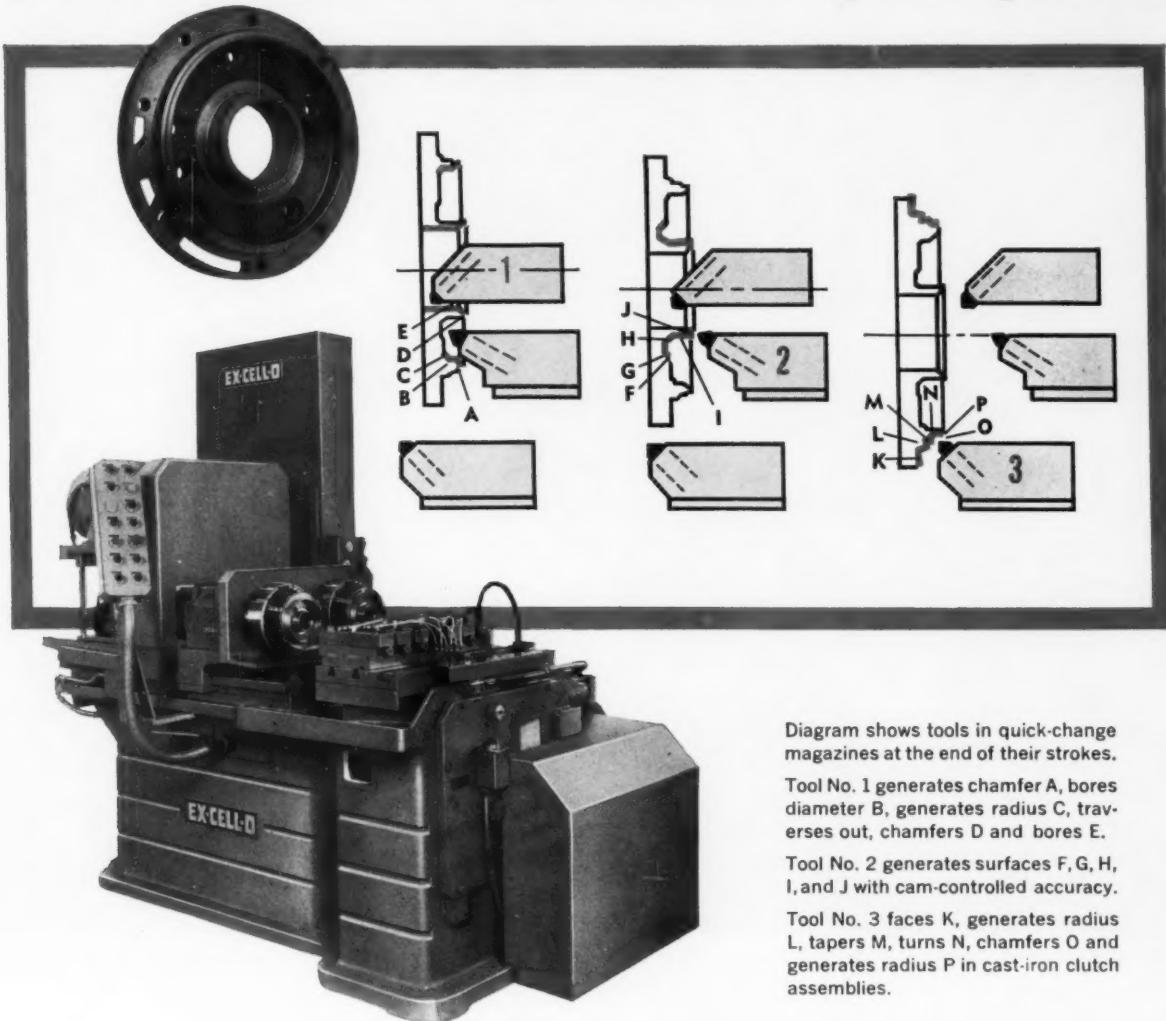


Diagram shows tools in quick-change magazines at the end of their strokes.

Tool No. 1 generates chamfer A, bores diameter B, generates radius C, traverses out, chamfers D and bores E.

Tool No. 2 generates surfaces F, G, H, I, and J with cam-controlled accuracy.

Tool No. 3 faces K, generates radius L, tapers M, turns N, chamfers O and generates radius P in cast-iron clutch assemblies.

Ex-Cell-O Cam-Operated Precision Boring Machines are designed especially for work requiring consistently precise boring, plunge-facing, grooving, chamfering and other O.D. and I.D. contours. Table and slide movements on hardened and ground ways are guaranteed by direct cam action—there are

no levers, no complex linkages. For maximum accuracy, cams can be ground for you in our plant on numerically-controlled machines.

Two models, 308 and 312, rough, semifinish and finish a wide range of parts. Ask your Ex-Cell-O Representative for data, or write direct for details.

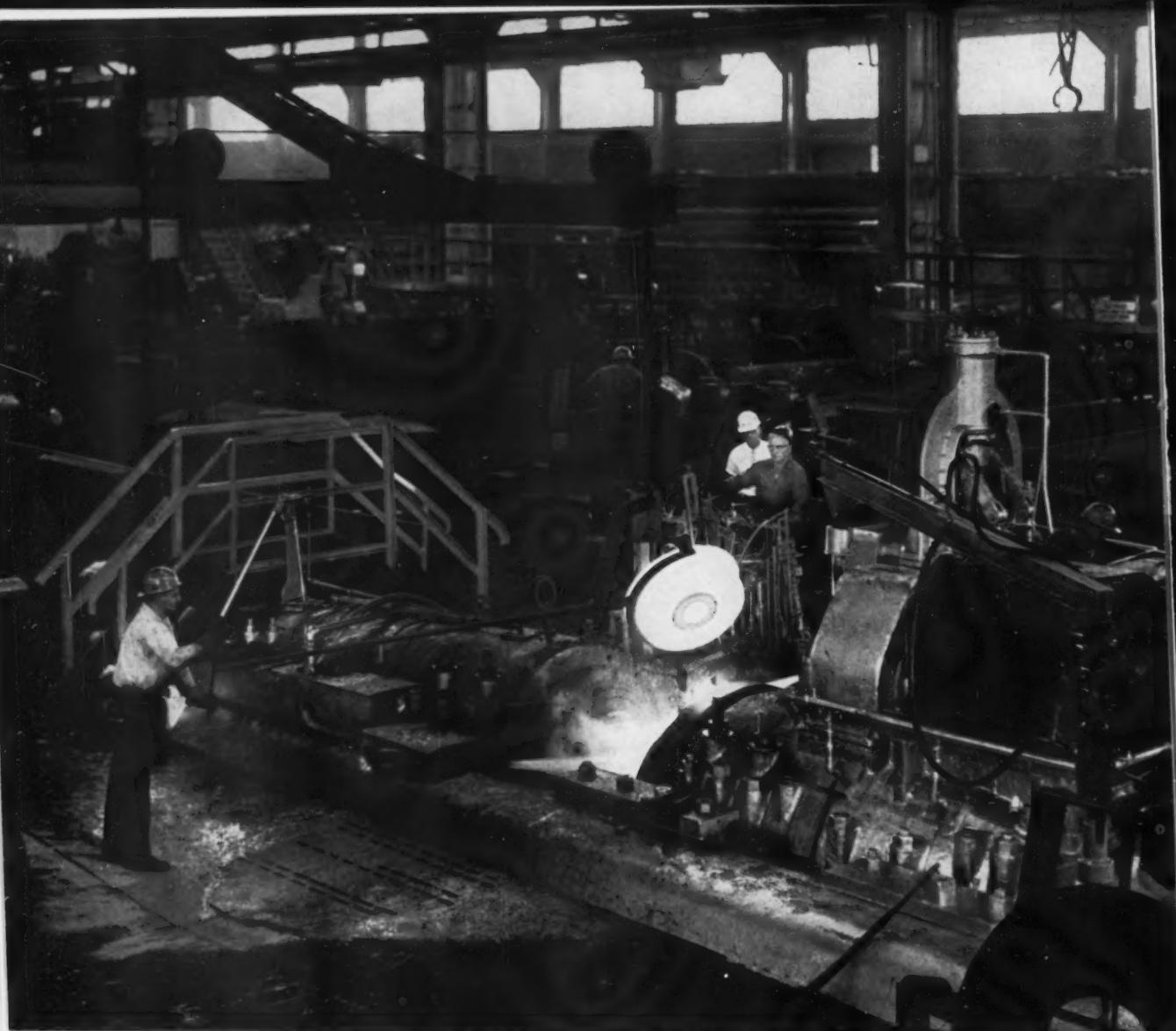
61-17M

EX-CELL-O FOR PRECISION

PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILLING BUSHINGS • JIG AND FIXTURE COMPONENTS • TORQUE ACTUATORS • CONTOUR PROJECTORS
CAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • COMPUTER PRODUCTS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN



Bethlehem's unique Slick Mill, named after its inventor, forges and rolls a circular forging—100 to 2,000 lb—in one minute.

SLICK

This is our Slick mill. It's the only one of its kind. It turns out a circular forging—gear blank, sheave wheel, compressor wheel, tire mold, or crane wheel—in less than one minute.

Thanks to quick die changes, it handles production runs as small as 25 to 50 pieces almost as economically as runs ten times as large.

It cuts conventional die charges in half because contact between die and work is so brief.

It produces light-weight sections without sacrificing strength . . . forgings with excellent grain flow, machinability, and soundness.

It's a pretty slick mill.

But that's not why it's called a Slick Mill. Edwin E. Slick is the name of the man who invented this unique mill. If you'd like to know more about how it can help you cut the cost of circular products, ask our nearest sales office. Or write to us at Bethlehem, Pa.



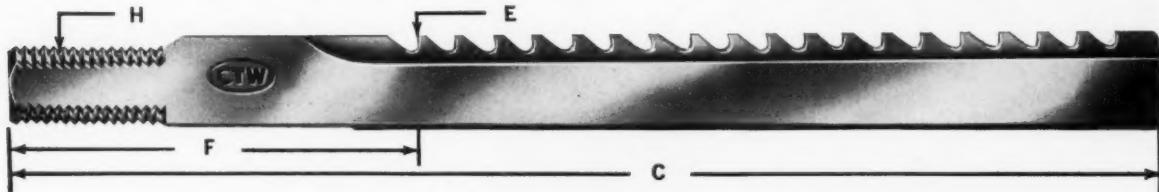
for Strength
... Economy
... Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



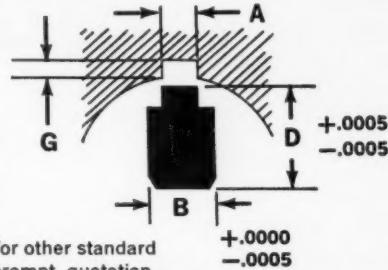
CTW Keyway Broaches in Stock NOW for Immediate Delivery!



Continental now stocks a popular range of standard keyway broaches to help you meet production schedules faster than ever, and to let you cut your tool inventory.

Just call your CTW Representative, or order by catalog number direct from Continental. The broaches you need are in stock now—ready for immediate delivery to your plant!

Sizes listed below are available for immediate delivery. See the CTW Catalog for other standard broaches. Special sizes quickly made to order. Send your print for a prompt quotation.



BROACHING INDUSTRY SERIES

Catalog Number	A Keyway Width			Min. Hole Size	Min.† Length Cut	Max. Length Cut	Width of Body B	Total Broach Length C	Height at Last Tooth D	Height at First Tooth E	Length of Shank F	Keyway Depth in Part G	No. of Cuts	Thread H
	Nom. Dim.	Decimal Dim.	Tolerance											
502	3/32	.0948	+.0002	7/16	1/2	1 1/2	.1865	24	.367	.309	8 1/4	.058	1	5/16-18
504	1/8	.126	+.0002	1/2	1/2	1 1/2	.249	30	.438	.364	9	.074	1	5/16
505	1/8	.126	+.0002	11/16	5/8	2 1/2	.3115	36	.594	.520	10	.074	1	5/16-13
508	5/16	.1885	+.0002	11/16	5/8	2 1/2	.374	36	.581	.476	10	.105	1	5/16-13
512	1/4	.251	+.0002	11/16	5/8	2 1/2	.374	36	.612	.476	10	.136	1	5/16-13
513	1/4	.251	+.0002	1	11/16	4	.499	45	.877	.741	11 1/16	.136	1	5/16-11
514	1/4	.251	+.0002	11/16	3/4	6	.624	51	1.250	1.114	13 1/2	.136	1	5/16-10
517	5/16	.314	+.0002	1	11/16	4	.499	45	.908	.741	11 1/16	.167	1	5/16-11
519	3/8	.3765	+.0002	11/16	11/16	4	.499	45	.938	.739	11 1/16	.199	1	5/16-11
520	3/8	.3765	+.0002	11/16	3/4	6	.499	54	1.189	.990	13 1/2	.199	1	5/16-11
523	1/2	.5015	+.0002	11/16	11/16	4	.624	48	1.312	1.051	12	.261	1	5/16-10
524	1/2	.5015	+.0002	11/16	1	8	.624	48	1.377	1.246	16 1/2	.261	2	5/16-10

ORIGINAL CTW SERIES

CTW 7	5/16	.1885	+.0002	11/16	1/2	2 1/2	.375	36	.581	.480	9	.101	1	5/16-13
CTW 10	1/4	.251	+.0002	11/16	5/8	2 1/2	.375	38	.612	.480	9	.132	1	5/16-13
CTW 11	1/4	.251	+.0002	1	11/16	3 1/2	.500	44	.877	.740	10	.137	1	5/16-11
CTW 14	5/16	.3135	+.0002	1	11/16	4	.500	46	.908	.740	10 1/2	.168	1	5/16-11
CTW 17	3/8	.376	+.0002	11/16	11/16	4	.500	46	.938	.740	10 1/2	.198	1	5/16-11
CTW 23	1/2	.501	+.0002	11/16	11/16	3 1/2	.625	46	1.422	1.160	10	.262	1	5/16-11

ORIGINAL XLO SERIES

XLO 3	5/16	.1885	+.0002	19/32	15/32	1 1/4	.250	28	.541	.438	8 1/4	.103	1	5/16-16
XLO 5	5/16	.1885	+.0002	5/8	5/8	2	.375	28	.541	.438	8 1/2	.103	1	5/16-13

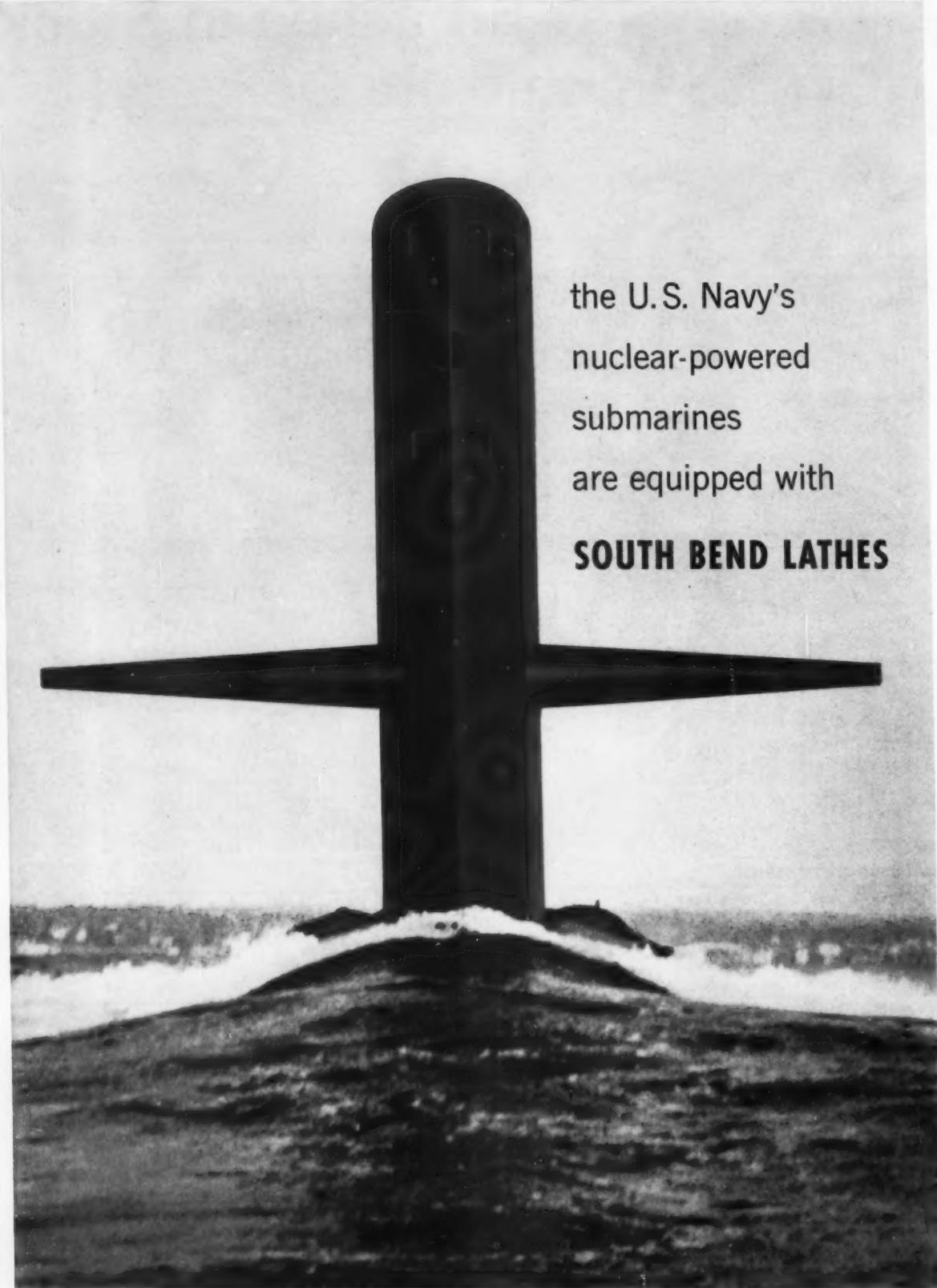
[†]MINIMUM LENGTH OF CUT RECOMMENDED TO PREVENT PART FROM DROPPING BETWEEN TEETH OF BROACH

Continental

CTW
TOOL WORKS
DIVISION OF

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

61-33C



the U.S. Navy's
nuclear-powered
submarines
are equipped with

SOUTH BEND LATHES

Official U.S. Navy Photograph

NOW A Continental Counterbore Set for New Standard Socket Head Screws!

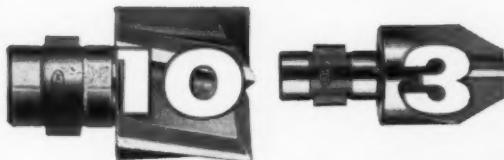


Designed especially for the stronger, safer 1960 Series socket head cap screws, the Continental No. 1B Standard Toolroom Set provides a wide range of sizes in a cost-saving, space-saving tool set. Supplied in a sturdy, fitted oak box, and equipped with a complete lineup of tools in the most-used sizes, the No. 1B gives you traditional CTW

quality and performance for toolroom or job shop counterboring, spot-facing and countersinking operations.

Call your local Ex-Cell-O Representative, or contact Continental Tool Works for details on the full line of CTW Counterbore Sets, and standard and special cutting tools and broaches.

STANDARD TOOLROOM SET NO. 1B CONTAINS:



- 10 hand-detachable CTW Counterbores for #6 through $\frac{5}{8}$ " dia. screw heads.
- 3 self-centering, hand-detachable CTW Countersinks.



- 17 hardened and ground counterbore pilots.



- 2 CTW Holders with non binding, "twist of the wrist" release action. (Available with Morse taper or straight shank.)

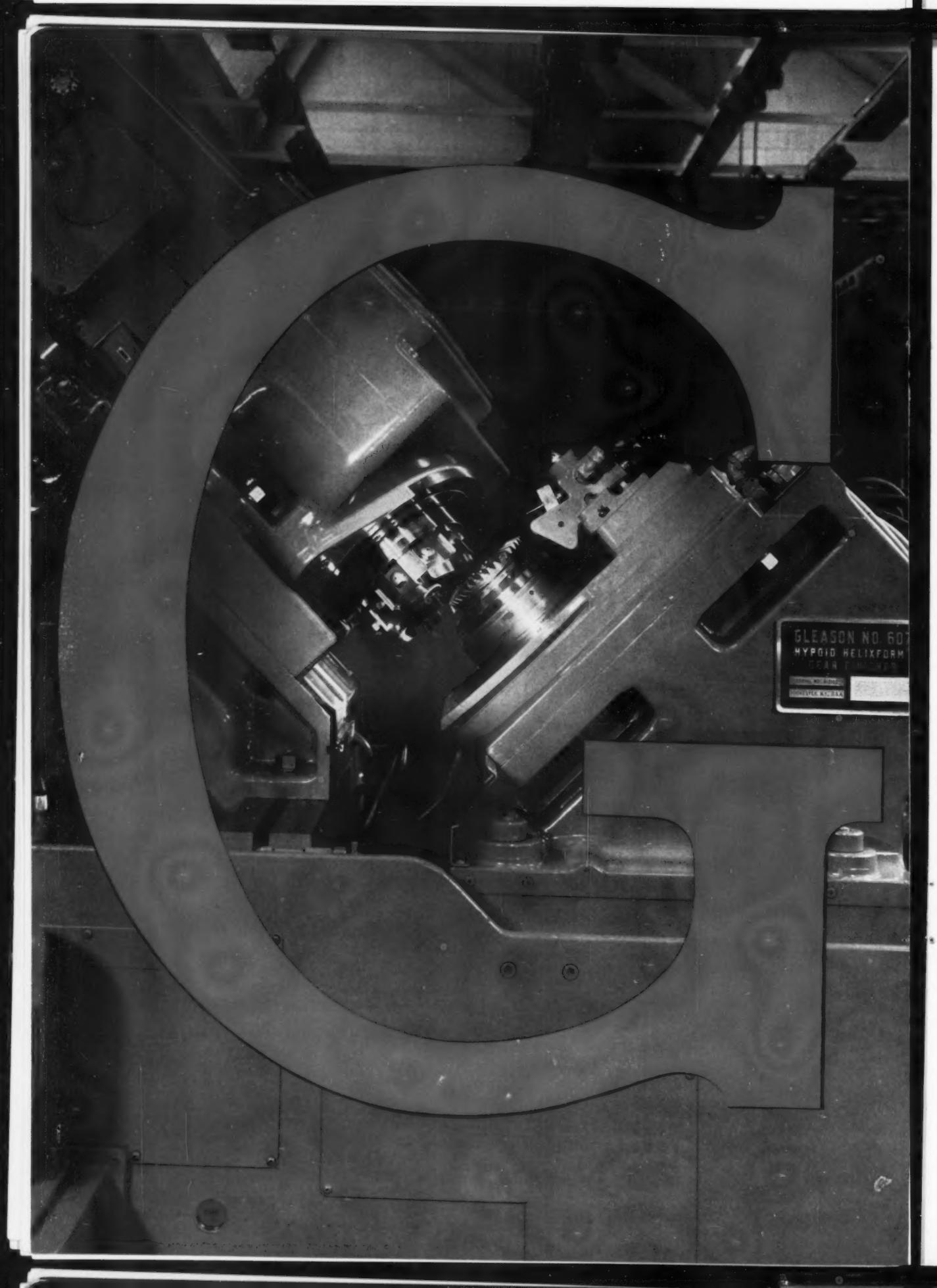
"No one has ever reported failure of a Continental Counterbore Drive!"

60-60

Continental

CTW
TOOL WORKS
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CORPORATION
DETROIT 32, MICHIGAN

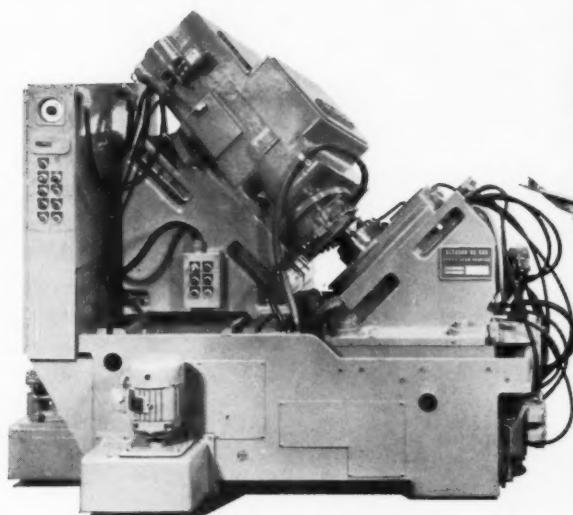


GLEASON NO. 607
HYPOID HELIXFORM
GEAR TRAIN
MONROVIA, CALIFORNIA

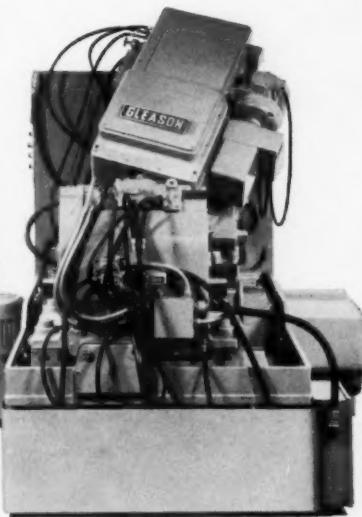
...PRODUCES QUIET, ACCURATE GEARS, UP TO 50% FASTER...AND SAVES FLOOR SPACE. These new Gleason "inclined-spindle" Hypoid Gear Cutting machines are primarily designed for faster, more accurate roughing and finishing of automotive main drive gears up to 10½" O.D. ■ Unique "inclined-spindle" design provides greater rigidity for precision cutting. ■ New type cutters, faster index and work clamp arrangements combine with automatic loaders to increase production up to 50%. ■ Yet, these new machines occupy 35% less floor space than previous

machines. ■ Set-up and operation are simplified . . . only four summary settings with simple gage bars to relate work and cutter. Any number of machines can be set-up with the same gage bars to produce identical gears . . . no expensive set-up fixtures needed. ■ New magnetic chip removal and coolant systems assure constant forced flow of clean oil over the work . . . help prolong cutter life, eliminate periodic cleaning, and minimize coolant loss. ■ For information on these all-new machines write Gleason Works, 1000 University Avenue, Rochester 3, New York.

A BRAND NEW ANGLE IN GEAR CUTTING . . .



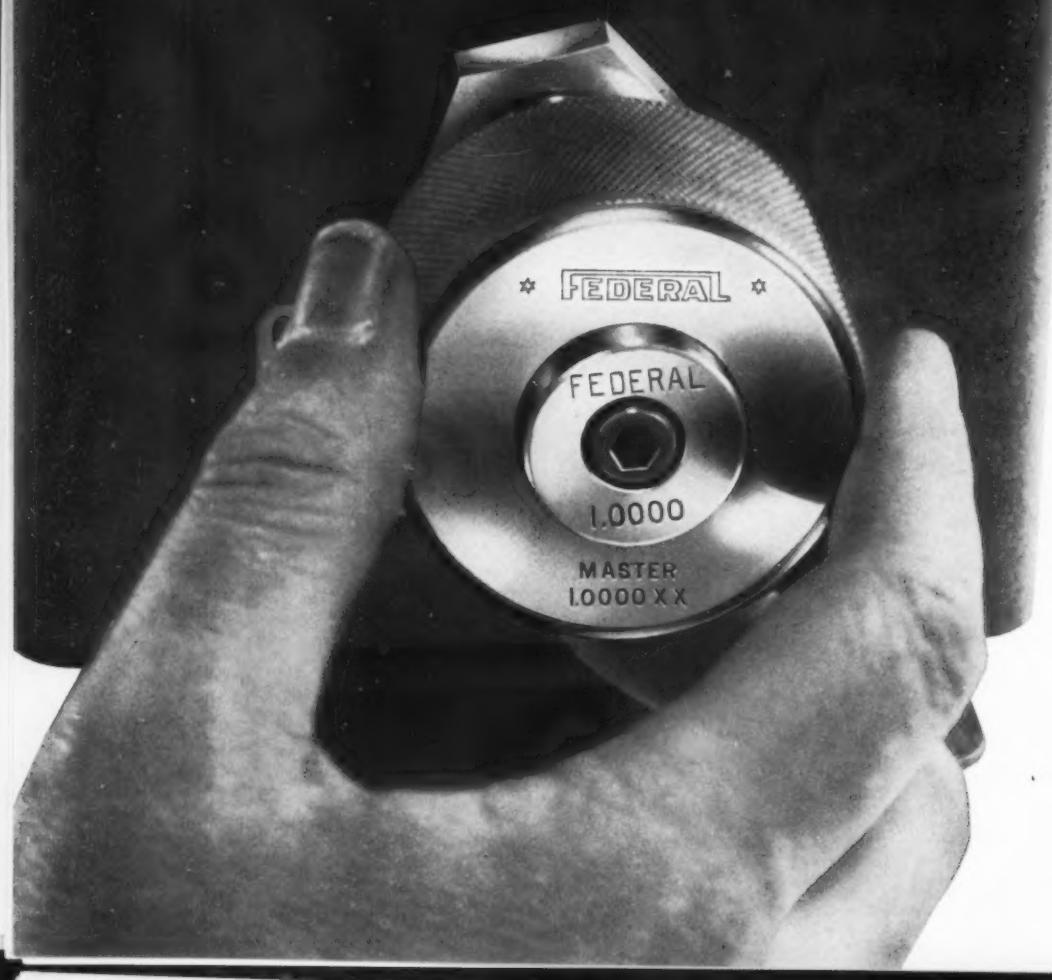
NEW GLEASON No. 606 Hypoid Gear Rougher



NEW GLEASON No. 607 Hypoid
Helixform Gear Finisher



NO



DOUBT ABOUT IT

... that's why the

DIMENSIONAIR

is the best air gage you can buy!

No doubt about the Dimensionair's readings

Such sharply defined calibration — the mark of a truly accurate gage — obviously gives you greater resolution, much finer readings than broadly defined graduations and wide hands or air-suspended markers ever can. Each time you gage with the Dimensionair, the needle-thin indicating hand advances smoothly, comes to a positive stop, yet is responsive to the slightest change. Its position in relation to the fine-line graduations is unmistakable. Such decisiveness, coupled with Dimensionair sensitivity, means much greater readability. In fact, tests prove that you get more information from the Dimensionair than from other air gages having *twice* the magnification.

No doubt that the Dimensionair maintains its accuracy

Dimensionair magnification is built-in . . . fixed. No adjustment can change it. That's why the Dimensionair, once set, *stays* set. Air pressure variations cannot affect the accuracy of the Dimensionair. Its balanced air circuit cancels them out. This achieves a stability which cannot be approached by other air gages.

No doubt the Dimensionair is easiest to use

Its fixed magnification and protection against drift guarantees *linear, calibrated* accuracy so you need only *one* master for set up . . . make only *one* adjustment to set zero. You're ready to gage in less than ten seconds! Dimensionair design gives you wide range operation (up to .006" depending on model selected)*. You also get greater plug clearance and more deeply recessed gaging jets for faster, easier gaging and longer life than is possible with other air gages.

All these advantages are based on the fact that the Dimensionair, unlike other air gages, is *built* to a specific accuracy and magnification. This is an important difference, as thousands of Dimensionair users can tell you. But don't just take our word for it . . . see for yourself. We will be glad to demonstrate the Dimensionair to you, either by itself or against any other air gage. We have offices all over the country. There's a Dimensionair near you, ready to be demonstrated.

FEDERAL PRODUCTS CORPORATION

11112 Eddy Street • Providence 1, R. I.

*FIVE MAGNIFICATIONS TO CHOOSE FROM:

- 1,250:1 (.006" range, each grad. = .0001")
- 2,500:1 (.003" range, each grad. = .00005")
- 5,000:1 (.0015" range, each grad. = .00002")
- 10,000:1 (.0006" range, each grad. = .00001")
- 20,000:1 (.0003" range, each grad. = .000005")

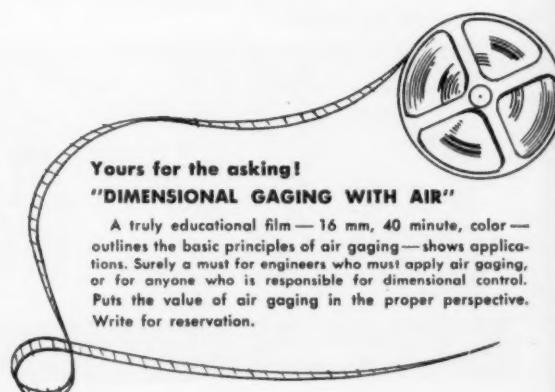
Ask **FEDERAL** First
FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Yours for the asking!

"DIMENSIONAL GAGING WITH AIR"

A truly educational film — 16 mm, 40 minute, color — outlines the basic principles of air gaging — shows applications. Surely a must for engineers who must apply air gaging, or for anyone who is responsible for dimensional control. Puts the value of air gaging in the proper perspective. Write for reservation.





Cover Story

A Tough Machining Job — Pioneer Astro Metallics Corp. had a tough machining job — they solved it the Hardinge way.



SUPER-PRECISION MACHINING...THE HARDINGE WAY!

Machining beryllium and other hard and valuable metals requires close tolerances and controlled scrap losses.

Hardinge machines are famous for Super-Precision machining to very close tolerances.

Features: pre-loaded ball bearing spindle; infinitely variable speeds and feeds; solid one-piece totally enclosed headstock; maximum rigidity for sustained accuracy; ease and simplicity of operation.



"**PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE™**

Production Pointers

from

GISHOLT



More cost-cutting IDEAS—
to help you

COMBINED OPERATIONS CUT BALANCING COSTS AT WISCONSIN MOTORS CORPORATION

Gisholt Balancer replaces two machines . . . improves quality

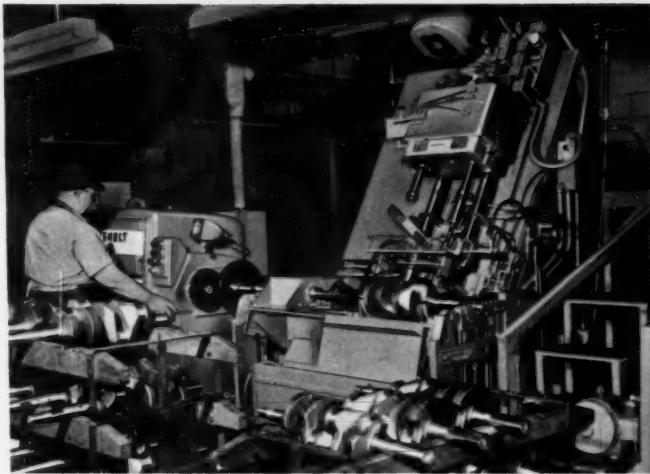
How long would it take you to recover the cost of a new balancer if it permitted you to perform the entire operation . . . including correction and inspection, in one fast handling? This setup at Wisconsin Motors Corporation, Milwaukee, Wisc., will give you a good idea of the savings that can be yours . . . if you come to Gisholt.

Four different crankshafts are used in Wisconsin Motors Corporation's extensive line of heavy-duty air-cooled engines. Previously, unbalance was located and measured on two machines. Parts were removed for correction by grinding and returned to the balancers for inspection. Two operators were needed. Time was long . . . and accuracy suffered through multiple handlings and operator interpretation of unbalance indications. Now, one Gisholt MASTERLINE 2U Balancer with integral correction drilling equipment does the job.

Although quality is improved, operator effort is reduced to a minimum. One-half ounce inch tolerances are maintained by automatic controls that free the operator from all complicated decisions. Idle time is cut by positioning blocks, job-setup charts, pre-set drills, quick-change adapters, and interchangeable drill heads and depth control cams. One man can change-over to any size crank in two hours or less.

Work is held in a fixture which is locked while weights are attached to the pin bearings to simulate effects of connecting rods and pistons in the final assembly. During rotation the operator flips two levers to locate angle and measure amount of unbalance in both planes. He turns two handwheels to set angularly graduated protractors that provide a visual record of the angle for each plane. He turns separate dials to electric-

Operator indexes work to indicated angle and presses button for automatic correction in left plane by $\frac{1}{16}$ " drill starting at $3\frac{1}{8}$ " radius on crankshaft counterweight. Pre-set drill in quick-change holder is shifted easily from right to left plane. Entire drill head is replaced to minimize changeover time.



Crankshaft rotates at 300 rpm and is supported on half-bearings in fixture that locks for correction drilling operations. Integral correction drilling equipment improves accuracy, permits one operator to perform complete sequence in one handling.

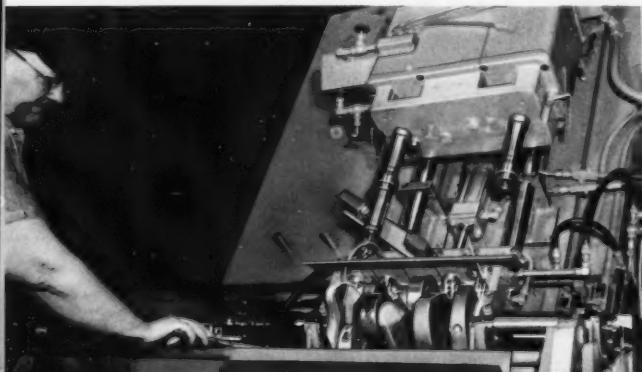
cally register the amount of unbalance in each plane. Then the operator stops rotation and locks the fixture. He indexes the part to the recorded angle in the plane where the drill is already in place from the previous correction and presses a button. Because the amount of unbalance has been electrically registered, the drill feeds to the required depth in the counterweight with no further attention by the operator. The drill is removed and placed in the head for the other plane and the process is repeated. Then the fixture is unlocked and the work rotated for inspection.

One Gisholt 2U Balancer replaces two machines, eliminates multiple handling and improves quality by combining location, measurement, automatic correction and inspection. Ask your Gisholt Representative to show you how these principles can be applied to your parts.

For more information on Balancers, circle No. 768.



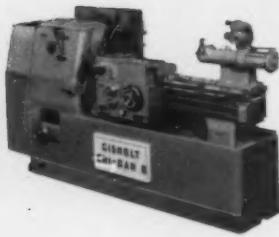
Top . . . largest part handled . . . weight 100 lbs . . . produced in lots of 125. Previous production 4 per hour . . . now 8 per hour. Smallest part at bottom . . . weight 35 lbs . . . produced in lots of 2,000. The 2U Balancer locates, measures, corrects and inspects at rate of 15 per hour.



OLD PROBLEMS SOLVED WITH NEW METHODS AT FORD TRACTOR & IMPLEMENT DIVISION

The next page and a half contains an article explaining how Ford Motor Company's Tractor and Implement Division, Birmingham, Michigan, has cut costs and improved product quality by trying two new approaches. Even more important is the fact that these goals were accomplished with less investment than would have been required had they purchased so-called "conventional" equipment to do this work.

BY AUTOMATICALLY MACHINING AND THREADING . . . Cri-Dan B offers low tool costs, peak accuracy and minimum threading times.

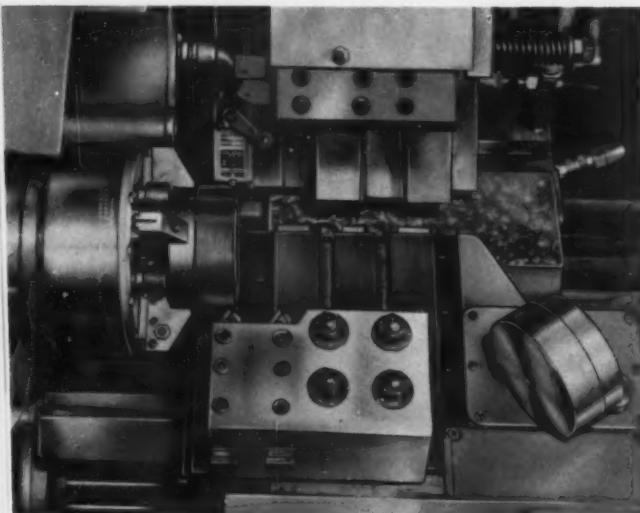


It's a fact. The new Cri-Dan Method can cut your threading costs by 30% to 80% with no compromise on quality. Here is how it is used in Ford Motor Company's Tractor and Implement Div., Birmingham, Michigan, to machine and thread SAE 1020 hydraulic accumulator cylinder ends.

Two sizes are handled. The same tools are used for both. After rough-machining, they are finished machined and threaded on a CRI-DAN B automatic threading lathe.

During the fast automatic cycle on the part shown, a 1½"

Simple Cri-Dan B setup saves time by combining facing and threading operations. A 1½" long, 16-NS Class 3A thread is generated by the single-point carbide threading tool in the front threading slide while the end is step-faced from the rear. Time . . . only 1.3 minutes f.t.f.



long, 16-NS Class 3A thread is generated on the 4½" diameter end in 22 passes with the single-point carbide threading tool. A second tool lags the threading tool and removes the partial thread created at the start of the cut. This eliminates any weak section that might roll over and cause service problems. At the same time, two tools on a rear facing slide step-face the end with automatic tool relief at the end of the cut. Time . . . only 1.3 minutes f.t.f.

This is a typical Cri-Dan job. The tooling looks simple . . . and it is, because the *inexpensive* single-point carbide tool can be set up in 8 to 15 minutes to produce any kind of thread . . . automatically. Even in the toughest materials, threads are produced in a fraction of the time required by other methods. You can eliminate costly thread milling cutters, thread grinding wheels and special taps and dies. And you can combine standard machining or tracing with threading during the automatic cycle, for maximum efficiency.

Cri-Dan reduces time, tool costs, and work-handling. Combines machining and threading, offers finer finish (125 microinches rms) and repeat accuracy on Class 3A threading operations.

For more information on CRI-DAN, circle No. 769.

BY CUTTING FINISHING TIME ON FLAT SURFACES

**Superfinish eliminates grinding
saves 50% on variety of
transmission parts**



If you think Superfinish is used for cylindrical surfaces only, you may be missing out on important savings. Gisholt Superfinish can be used to cut time and tool costs on cylindrical, flat, tapered or spherical work. It can also eliminate tedious, more expensive methods.

For example, this setup at Ford Motor Company's Tractor and Implement Div., Birmingham, Michigan, has eliminated flat surface grinding and cut time in half on nine automatic transmission parts. Seven are Superfinished at both ends and two on one end for a total of 16 surfaces. Two, identically tooled MASTERLINE Model 81 Vertical Superfinishes handle all production.

Five of the parts are illustrated with some of the Superfinished surfaces indicated by arrows. The part in the air operated expanding mandrel fixture on the lower work spindle is a planetary gear carrier. During the automatic cycle, the Superfinish wheel descends to engage the flat surface and rotates in an opposite direction to the work spindle. A special variable speed drive arrangement keeps cross-hatch pattern to a minimum as the precision-faced surface is reduced from 120 to 10 microinches rms. Floor-to-floor time . . . only 30

continued on next page

FORD STORY . . . CONTINUED

seconds. The other parts are handled in the same manner . . . to the same degree of finish . . . in the same amount of time.

With Superfinish you get any surface you require . . . whether it's 1 microinch rms or 80, piece-after-piece, automatically! Part geometry is improved, surface imperfections are eliminated, and jagged peaks are "scrubbed" away, giving up to 80% more bearing area. Smear metal is removed and base metal exposed so that specified hardness is maintained, to assure long service life.

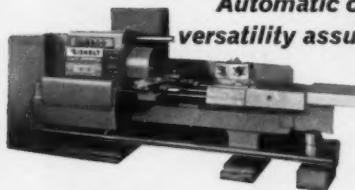
Flat surface Superfinishing eliminates grinding, cuts finishing time in half on nine transmission parts. Offers further savings in initial cost, setup time and tooling.

For more information on Superfinish, circle No. 779.

One of two identically tooled Gisholt MASTERLINE Model 81 Vertical Superfinishers used to handle 16 surfaces on nine different automatic transmission parts. On each part, the precision-faced flat surfaces of 120 microinches rms are reduced to 10 microinches rms in only 30 seconds, f.t.f.



NEW FASTERMATIC OFFER 15 MINUTE CYCLE SETUP



This story illustrates how non-productive setup time has been reduced to a minimum, so you can get all the advantages of turret lathe practice with an automatic cycle on short or long run work.

The machine shown is a new Gisholt MASTERLINE 3F Fastermatic with FeeDial Control. Fast, 15-minute setup makes the Fastermatic ideal for short run use. Individual dial controls select the exact feed for each station. The feed rate is shown in *inches per revolution* in windows at the top of each dial! Selector panel switches are "flicked" to pre-set speeds

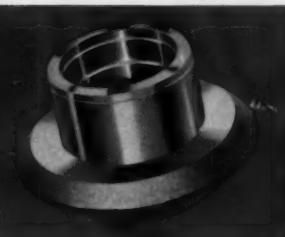
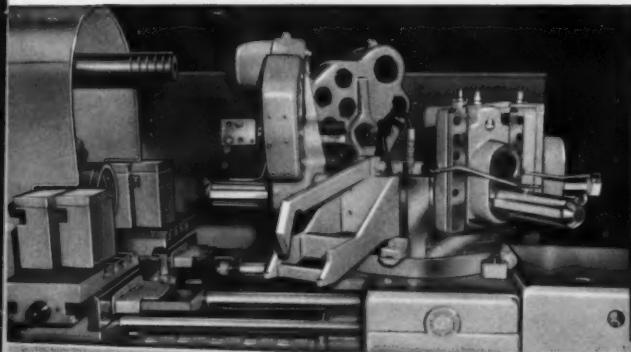
and machine functions for the six turret and two cross slide stations. Adjustment of traverse and feed trips, on a small hex drum at the headstock end completes the cycle setup.

Tool setting time is also reduced. The operator can take a test cut at any station, back up, mike the part, reset his tools and repeat the sequence *without indexing through the other five stations*.

The 3F FASTERMATIC is shown tooled for first operation work on $11\frac{1}{2}$ " diameter, 7" long steel bevel pinion forgings. A turret-mounted loader speeds locating and chucking. During the cycle, hex turret stations rough and finish turn two O.D. diameters, core-drill and finish three bore diameters. Rear and front cross slide tools operate with hex stations 1 and 2 respectively, to rough and finish machine two faces. Rigid machine design and a 40 hp motor permit rough turning using .015" feeds to remove up to $\frac{1}{8}$ " stock per side and core-drilling with up to $\frac{1}{2}$ " stock per side removed. Time is 13.3 minutes f.t.f.

The Fastermatic with FeeDial Control is available in three sizes. Fast 15-minute cycle setup, heavy metal removal capability and turret lathe flexibility guarantees top profits on your toughest parts.

For more information on Fastermatics, circle No. 771.



Tooling setup . . . utilizes turret-mounted loader (front) to speed locating and chucking of heavy part. Note how multiple tools are used with the automatic cycle to machine a maximum number of surfaces per chucking . . . to consistent quality at fixed rates. The operator is free during the automatic cycle to handle other machines. Inset shows workpiece and surfaces machined in only 13.3 minutes floor-to-floor.

TRACING SIMPLIFIES TOUGH CONTOURS AT WALTER KIDDE

JETracers on ram and saddle type turret lathes save time and tool costs

Walter Kidde & Company, Inc. of Belleville, N.J., has produced thousands of forged steel Jato nozzles each month—used to boost "take-off" power of heavily loaded aircraft. The way they solved the problems of machining tough internal and external contours may give you some ideas for your own operations.

The parts shown in these setups are $9\frac{3}{8}$ " long. Diameters range from $2\frac{3}{4}$ " at the small end to $5\frac{3}{8}$ " at the bell end. For first operation machining of the bore, a Gisholt 2L Saddle Type Turret Lathe is used. The setup is shown in Fig. 2 . . . the workpieces at left in Fig. 3. Work is held in a pot-type collet fixture. A turret-mounted JETracer slide tool removes from $\frac{3}{8}$ " to $\frac{1}{2}$ " per side at .011" feed as it completes the 7" long I.D. contour. Surface speeds range from 580 to 200 feet per minute. Time is only 3.48 minutes f.t.f.

A Gisholt Ram Type Turret Lathe is used for second operation machining of the O.D. contour. The setup is shown in Fig. 1 . . . the work pieces at right in Fig. 3. Work is held in the bore on an air chuck and located at the bell end against three special jaws that distribute chucking pressures to avoid possible distortion. A turret-mounted center provides additional

View from rear of No. 5 Ram Type Turret Lathe shows flat template used to control single-point carbide tool on JETracer slide, mounted on rear of cross slide. Turret-mounted center supports as contoured O.D. is traced removing $\frac{1}{4}$ " to $\frac{1}{2}$ " stock per side in 1.53 minutes f.t.f.

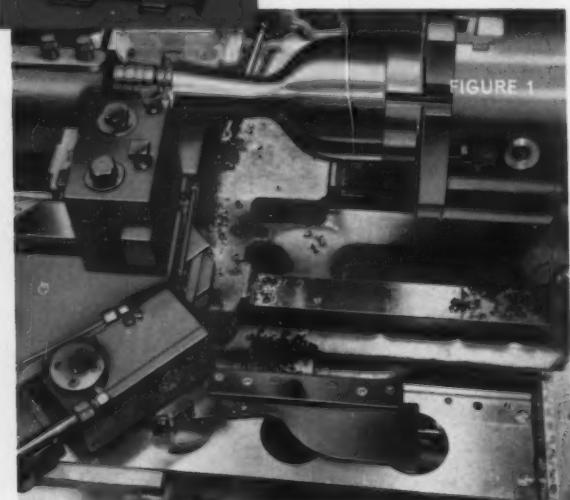


FIGURE 1

FIGURE 2



Gisholt 2L Saddle Type Turret Lathe with turret-mounted JETracer slide tool, used for first operation contour boring of Jato nozzles in 3.48 minutes f.t.f. JETracer stylus follows flat template held on carrier bar and has micrometer adjustment. Template and carrier bar locate from adjustable bracket attached to overhead pilot. Entire assembly can index with turret and does not restrict use of other tooling.

support. A single-point carbide tool on the JETracer, mounted on the rear of the cross slide, is governed by the flat template as it removes from $\frac{1}{4}$ " to $\frac{1}{2}$ " per side at .021" feed, to complete the 11" long O.D. contour. Again, surface speeds range from 200 to 580 feet per minute. Time is 1.53 minutes f.t.f.

Even though you may not machine Jato nozzles, tracing



First operation machining handled on Gisholt Saddle Type Turret Lathe with turret-mounted JETracer slide tool. Rough part at (a); machined part at (b). Second operation machining handled on Gisholt Ram Type Turret Lathe with JETracer mounted on rear of cross slide. Rough part at (c); machined part at (d).

can offer many cost-cutting advantages. These include fast setup and changeover, simplified machining and minimum requirements for operator skill. Costly form tools, multiple tool blocks and holders can be eliminated. Inspection time is reduced and there are fewer secondary operations.

Gisholt offers over 28 different JETracers for use with manual and automatic turret lathes and single-spindle automatics. Each operates at full capacity of the machine to which it is applied and does not limit machine functions or restrict use of standard tools.

For more information on JETracers, circle No. 772, on Rams, circle No. 773, on Saddles, circle No. 774.

GISHOLT
MACHINE COMPANY
DEPT. 811, MADISON 10, WIS.

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Turret Lathes • Automatic Lathes • Balancers • Superfinishers

Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products



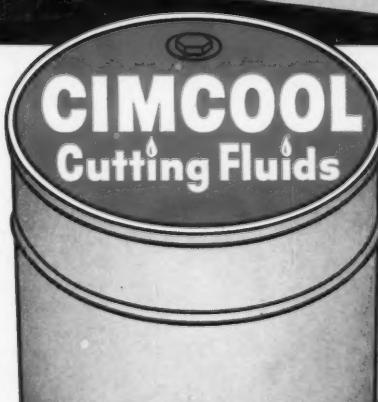
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CIMPERIAL SOLVES GRINDING ROOM PROBLEMS

for parts manufacturer. Another success story for versatile
CIMPERIAL, heavy duty cutting fluid of famous CIMCOOL line.

(Company name on request.)



FOR 100% OF ALL METAL CUTTING JOBS

Production-Proved products of The Cincinnati Milling Machine Co.

FIVE-STAR CIMCOOL—Newest in the industry-proven line of CIMCOOL® Cutting Fluids.

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ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

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NIKON OPTICAL COMPARATOR

new model 3A offers unusual screen brightness and image resolution — features zoom-condenser system

The unusual image brightness, definition and accuracy achieved in the new model 3A—to the very edge of the screen—is a credit to the quality and design of its optical system.

The new Nikon model 3A permits surface as well as contour inspection—individually or simultaneously. And controls are provided for adjusting the intensity of each of the illuminators.

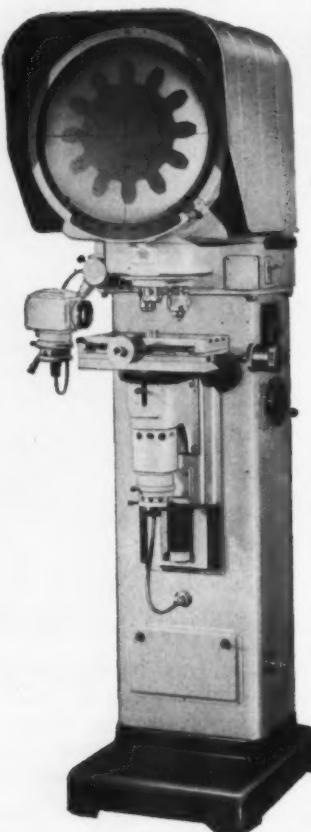
The surface illuminator may be used obliquely to emphasize surface texture. Or, for greater measurement accuracy, the surface illuminator may be used in conjunction with lens-mounted, half-reflecting 45° angle mirrors to provide shadowless light on the optical axis. Contour illuminator employs a special zoom condenser matching system. Convenient control simplifies adjustment for optimum illumination at each magnification.

Model 3A is normally supplied with a choice of one or more standard lenses in magnifications ranging from 10x to 100x. Other magnifications are also available on special order. A 3-lens turret supplied as standard equipment, facilitates instant changes. Focusing is smooth and effortless. Utilizes leadscrew drive with scraped ways and adjustable gibs.

The model 3A is equipped with a sliding hood which may be drawn out to shade the screen, or can be retracted to permit ready access to chart or screen surface. The overall diameter of the screen glass is 14½", designed for use with standard charts.

The new Nikon 3A accepts a wide variety of micrometer stages, holding fixtures, protractor screens, charts, photo attachments, and other accessories. For details write to Dept. M-12.

features new 14" screen



NIKON INCORPORATED

Instrument Division

111 Fifth Avenue New York 3, N. Y.

Another Special by Cross

FLEXIBILITY to process 25 different parts

Flexibility is featured in this Cross machine. One machine processes a variety of 25 different parts. The key to this flexibility is the fixture which holds any one of these varied parts with simple adapter changes.

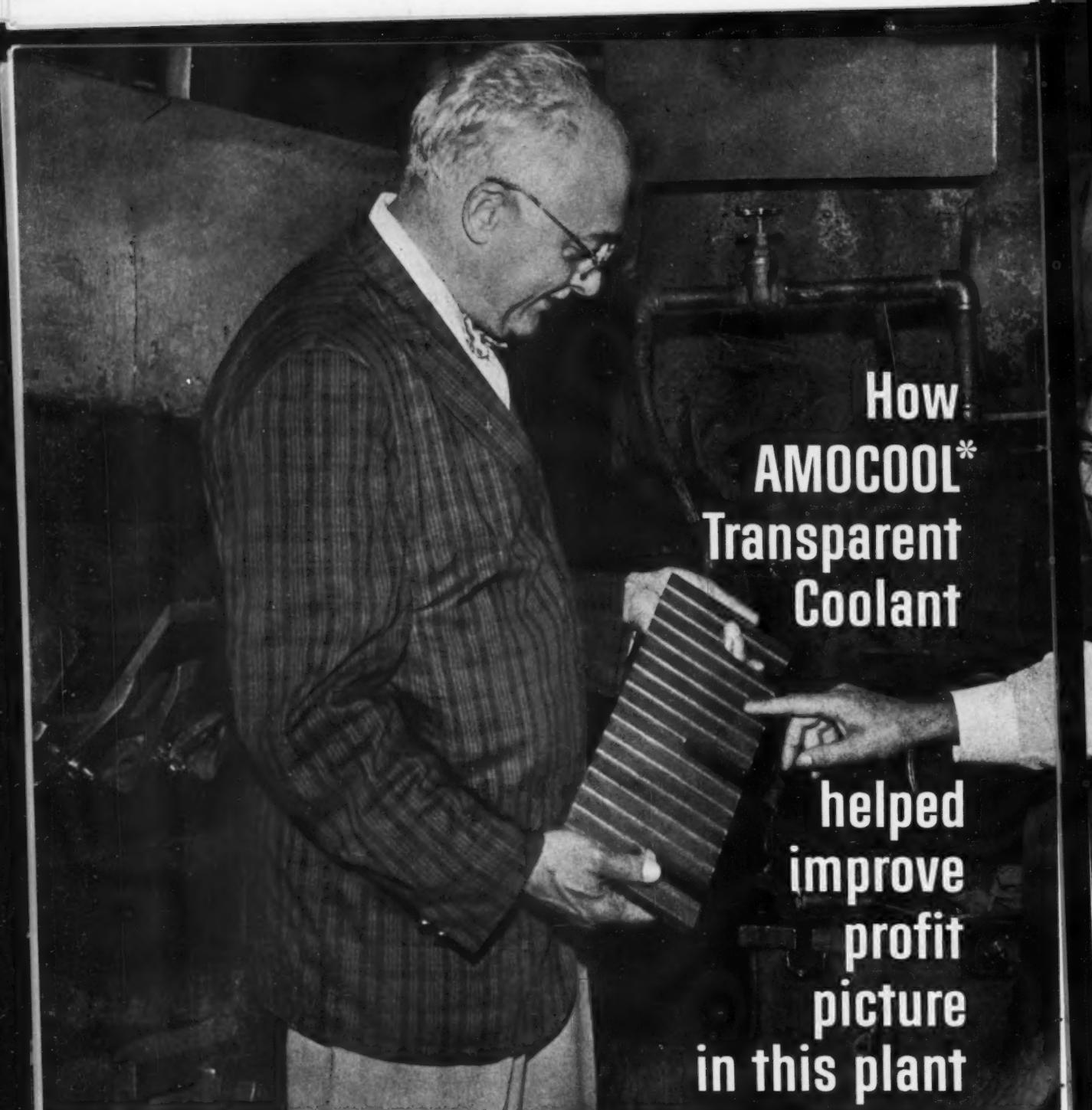
The machine produces 675 pieces per hour and automatically unloads them onto a conveyor.

An improved chip and coolant system includes a conveyor that reaches right into the machine to remove the stringy chips.

The flexibility and efficiency you require is available in special machines by Cross.



Established 1898
CROSS CO.
First in Automation
PARK GROVE STATION • DETROIT 5, MICHIGAN



How AMOCOOL* Transparent Coolant helped improve profit picture in this plant

*Trademark

BY PAUL E. "PAPPY" STRATTON

About the Author. "Pappy" Stratton has been providing technical help on lubrication and metalworking problems to customers in the Detroit area for nearly all of the twenty-five years he has been work-

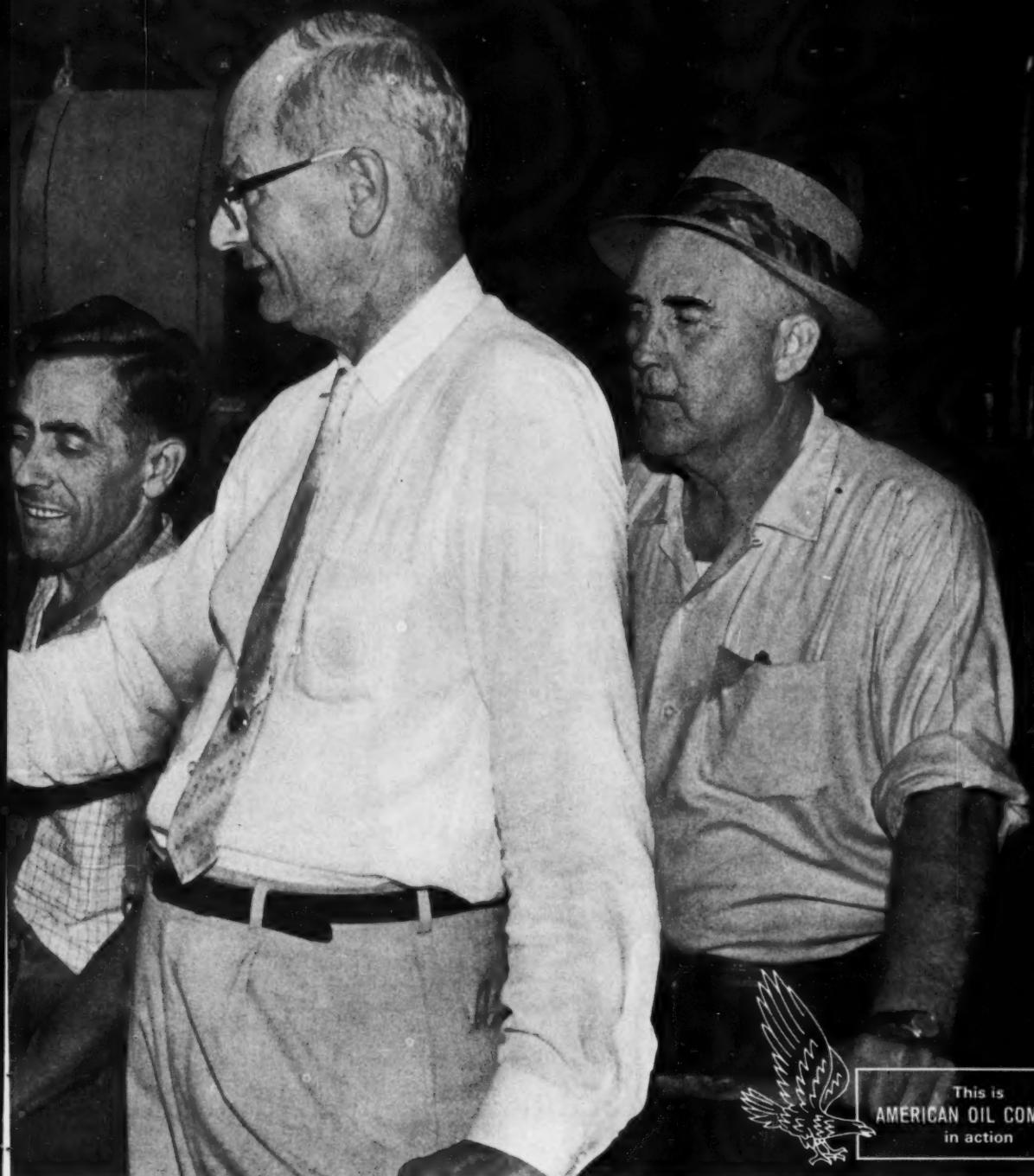
ing for the company. In addition to having this store of practical experience to help him, Pappy has completed the Company's Sales Engineering School.

* * *



By using a soap-base grinding compound, Detroit Edge Tool Company was getting excessive corrosion and rust on work and grinding machines. Oil vapor was collecting on machines and on the ceiling, causing dirty working conditions. Most important, high wheel loading was causing frequent down-time for wheel dressings.

We worked out a test program on AMOCOOL Transparent Coolant with the management. On our first test on one surface grinder, feed pressure was cut substantially while at the same time metal removal was increased.



This is
AMERICAN OIL COMPANY
in action

Eliminate reworking because of rust, reduce wheel loading and extend intervals between wheel dressings; do these and you increase profit per unit, explains Detroit Edge Tool president, Dan Ebbing, to P. E. "Pappy" Stratton of American Oil. Plant manager, John Yonker (right) and Sam Vineh, operator, look on.

The cost of reworking parts to remove rust was eliminated. Time required to clean machines to get rid of the odor was cut in half. Less wheel loading and fewer wheel dressings have upped production and reduced costs. Our test program paid out in an improved profit picture. All grinding and drilling equipment has been converted to AMOCOOL Transparent Coolant.

* * *

Would you like this kind of technical help to assist you in improving profits? Get it by calling the American Oil Company office nearest you.

**Quick facts about
AMOCOOL®
Transparent Coolant**

- Clear, transparent fluid
- Controls corrosion on work and machines
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Fire resistant
- Odorless



**AMERICAN OIL
COMPANY**

910 South Michigan Avenue
Chicago 80, Illinois



The Friden Flexowriter® Machine Tool's Machine Tool

At the recent Machine Tool Exposition, approximately 80% of the numerically controlled tools on display featured 8-channel punched paper tape input.

The toolmakers have shown this overwhelming preference for punched paper tape for several reasons:

- 1) the tapes are easy to prepare,
- 2) the coding is visible,
- 3) tape can't get out of sequence,
- 4) tape is durable and unaffected by chance exposure to magnetic fields.

By standardizing on paper tape input for your numerically controlled tools, you get all the benefits listed above, plus one more: It's so much easier (and less expensive) when all of your numerically controlled tools can be

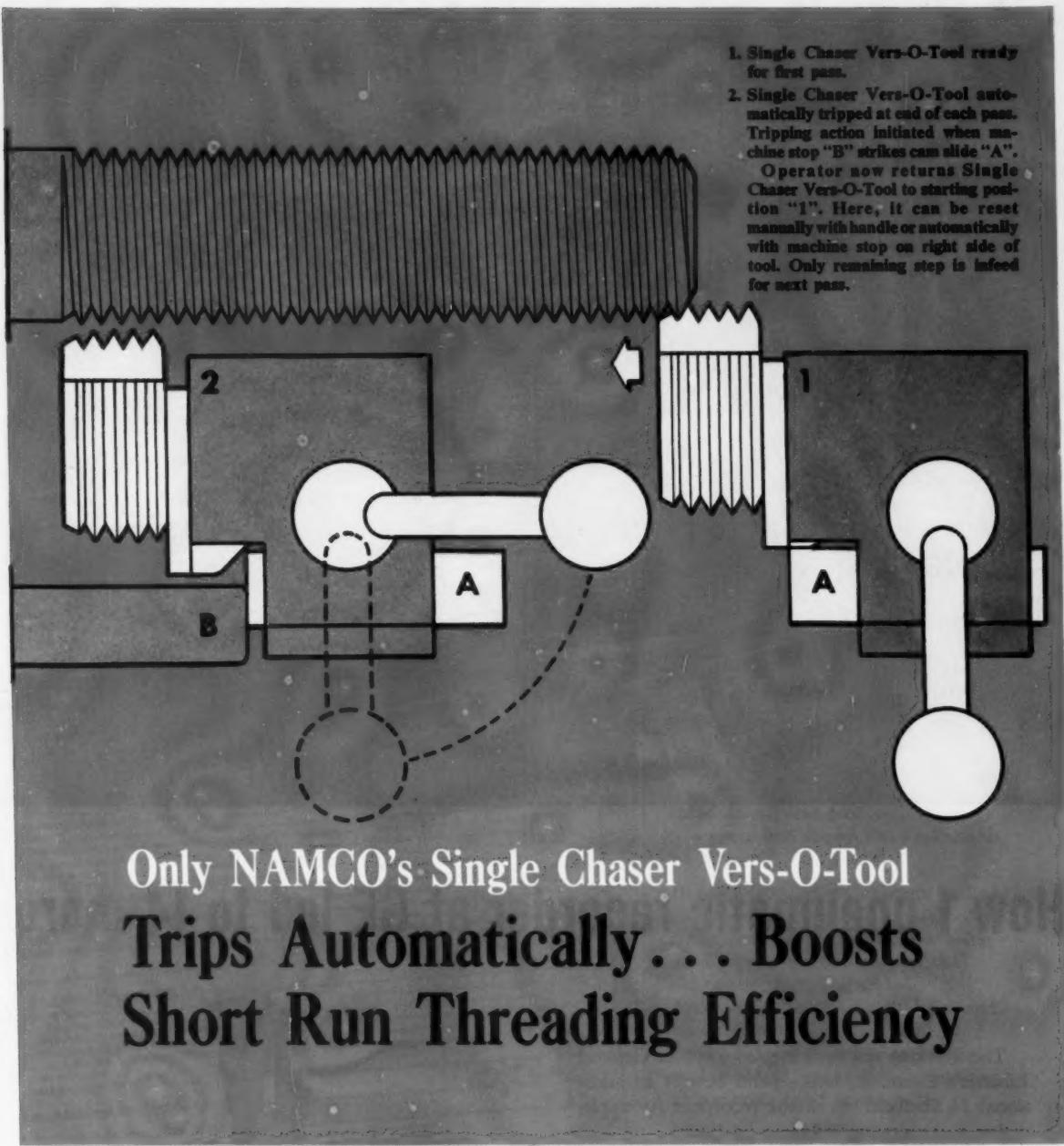
programmed on one device. That device? The Friden NC-1 Flexowriter—the machine tool's machine tool.

THIS IS PRACTIMATION: *Friden is the world leader in tape technology and the practical application of the automation it makes possible. For full information, call your local Friden Systems Representative. Or write: Friden, Inc., San Leandro, California.*

© 1961, FRIDEN, INC.

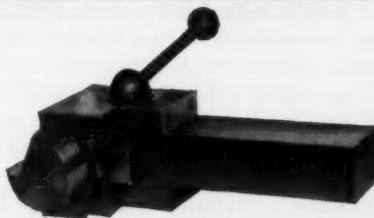
 **Friden**

Sales, Service and Instruction Throughout the U.S. and World



Only NAMCO's Single Chaser Vers-O-Tool Trips Automatically... Boosts Short Run Threading Efficiency

Unlike other single point threading tools, NAMCO's Single Chaser Vers-O-Tool backs off automatically at the end of the cutting stroke. For short runs, this means more threading in less time. And, because it just isn't possible to attempt the return stroke while the tool is still at cutting depth, scrapage is eliminated. The tool's multiple cutting edges mean greater threading accuracy and longer tool life while NAMCO's exclusive resharpening method permits quick tool change and precise reset. In short, *nothing* beats NAMCO's Single Chaser Vers-O-Tool for short run threading efficiency. Get complete details on this and all the rest of NAMCO's complete line of Vers-O-Tools. Write today for our 44 page Bulletin DT-60.



**National
Acme**

THE NATIONAL
ACME COMPANY
179 E. 131st STREET
CLEVELAND 8, OHIO

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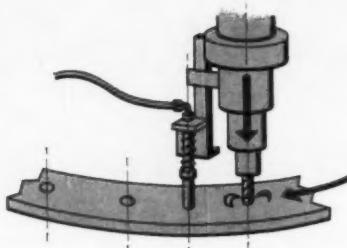
How 1 pneumatic recorder at GE led to 14 more

The first one did such a good job that General Electric's Evendale, Ohio, plant bought an additional 14 Sheffield pneumatic recorders, for application to automatic indexing jig borers.

An adjustable bracket on the quill holds a floating air spindle. After each hole is bored, the spindle enters the hole, automatically records the bore size. If the hole is within limits, the next hole is bored. If the diameter is not within specifications, the operator is warned by both lights and a buzzer.

The Sheffield Pneumatic Recorders proved so reliable that dimensions recorded at the machine have—in many cases—eliminated the need for subsequent inspections.

Write for Bulletin PREC-212.



The
SHEFFIELD
Corporation Dayton 1, Ohio

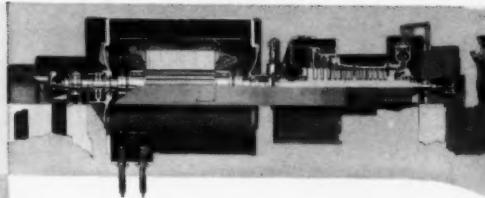
A subsidiary of The Bendix Corporation

Inspection Gages, Dimensional Control Instruments, Machine Controls, Automatic Gaging & Assembly Systems, Measuray® X-Ray Thickness Measuring, Crushtrue® & Multiform® Grinders, Cavitron® Ultrasonic Machine Tools, Press-Pacer® Transfer Units, Large Dies, Tooling, Contract Manufacturing.

Value of replacement formula shown at ALLIS-CHALMERS



ANOTHER WORKSHEET FROM ITS FILES



ALLIS-CHALMERS MFG. CO.		CAPITAL EXPENDITURE ANALYSIS	
WORK	Welding	DATE	June 22, 1961
1. SUBJECT OF ANALYSIS	Compare savings resulting from the use of a semi-automatic dual shield Welding Machine over Stick Electrode welding of wicket gates.		
2. ANTICIPATED RATE OF PRODUCTION	150 Gates per Year.		
PROPOSED EQUIPMENT (P)		EXISTING EQUIPMENT (E)	
3. Estimated Cost Installed	\$ 2,650	Resale, Salvage or Conversion Value	\$ ---
4. Net Amount Required (P - E)	\$ 2,650	Restorative Repairs	\$ ---
5. Description: 1 - Dual Shield Welding Machine equipped to weld stainless steel	Description: Manual welding with coated electrodes.		
6. Machine Life:	15 Years	Years of Life To Date	Installed Cost \$ ---
7. Estimated Service Life:	125 Years	Purch. Date: ---	Tool No. ---
8. Estimated Salvage Value	\$ 125	Bldg. No. ---	Dept. No. ---
10. Salvage Factor (Line 9B ÷ Line 3P)	4.7 %		
FACTOR		PROPOSED EQUIPMENT (P)	
11. Direct Labor (For Anticipated Production)	\$ 1,945	(P)	3,110
12. Indirect Labor (For Anticipated Production)	907	(E)	1,450
13. Fringe Benefits	882		3,420
14. Defective Material, Labor & Mfg. Burden	18		29
15. Down Time	--		--
16. Power Consumption	24		38
17. Tooling	4,100		5,040
18. Suppliers	58		--
19. Floor Space: (If Usable)	39		62
20. Property Taxes and Insurance	--		--
21. Maintenance and Repairs	--		--
22. Inventory	--		--
23. Sub Contract Costs	--		--
24. Other Items (Explain on Reverse Side)			
Totals: (P) \$ 7,973	(E) \$ 11,149		
		\$ 3,176	
25. Next Yr. Variance in Operating Cost (Line 25E - Line 25P)	--		
26. Restorative Repairs I	Years Effective		
27. Salvage Value Loss Next Year	--		
28. Salvage Value Loss Next Year	--		
29. Next Years Cost Of Retaining Existing Equipment (Line 27 + Line 28)	--		
30. Total Next Years Cost For Existing Equipment (Line 26 + Line 29)	\$ 3,176		
31. Total Next Years Cost For Existing Equipment After Taxes (Line 30 + 50%)	1,588		
32. Chart Allowance For Proposed Equipment, Chart 3.6% (3P) (See Reverse Side For Calculations)	95		
33. Return On Investment After Taxes (Line 31 - Line 32)	56.3 %		
34. Percent Return On Investment After Taxes (Line 33 + Line 4P)	--		
**When the chart allowance is used on line 32 the percentage developed on line 34 represents the after-tax return after allowing for the standard rates of return on equity capital and interest on borrowed capital.			
CALCULATED BY		APPROVED BY	
E. C. Chaffey		Harry M. Palmer	
DATE 5/22/61		DATE 6/2/61	
USE REVERSE SIDE FOR CALCULATIONS			

From time to time Allis-Chalmers Manufacturing Company, through Mr. W. S. Pierson, Comptroller, and other executives, has contributed valuable information concerning equipment analysis and replacement for use on this page. We now are privileged to reproduce another analysis form from the files of this company.

About a year ago Allis-Chalmers decided to make full use of the new MAPI approach to equipment analysis and to apply it on all projects and expansions. The experience with the standard, or old-type, MAPI Analysis, for replacement only, had been satisfactory, and post audits for five years had shown the findings to be correct.

Reports from Allis-Chalmers indicate that the new one-sheet capital equipment analysis form now being used retains the accuracy of the old, while providing added flexibility. The new Capital Expenditure Analysis is applied to all fixed asset expenditures including replacements, expansions, rebuilding or restoring fixed assets.

With the new capital expenditure analysis projects can be ranked, not only by the rate of return, but also in conformity with the company current and projected budgets.

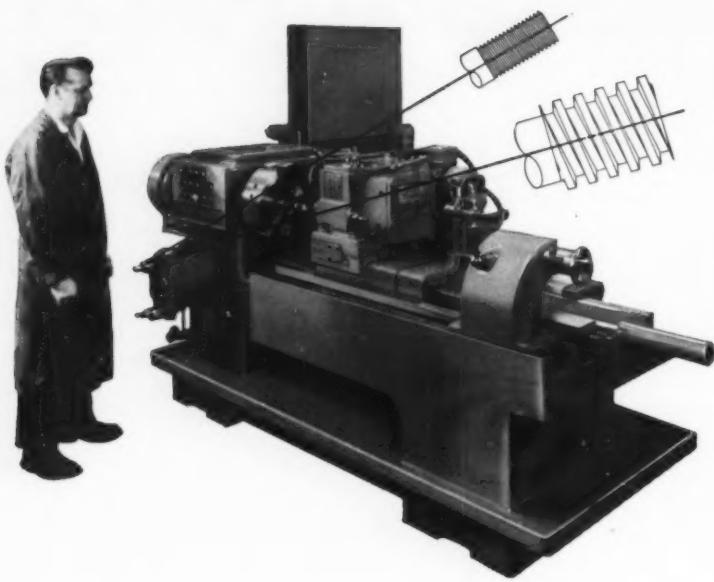
* Gain from replacement by the Allis-Chalmers formula . . . after required interest or return on the new investment . . . after full allowance by the formula for future obsolescence of the new equipment.

December, 1961

Keep gathering metalworking production ideas... be well informed when you replace machinery

Rockford Insert Group . . .

AUTOMATIC THREAD MILLING



Check these important benefits of Sundstrand thread milling

- Mills internal or external threads . . . right- or left-hand . . . straight, tapered, or special . . . on straight or interrupted work surface, such as splines, key slots, and flutes.
- Makes external threads one pitch away from a shoulder . . . internal threads one pitch from bottom of a blind hole.
- Accurately relates pitch diameters to other elements of the workpiece.
- Mills threaded and plain diameters simultaneously.
- Simultaneously mills two threads of the same pitch and lead on the same or different diameters.
- Threads workpieces of various diameters with a single cutter.
- No special operator skills are required to consistently produce tolerances and finishes finer than normally obtained with single-point tools or taps and dies.

Here's an automatic thread milling machine that provides high production and precision accuracy on a wide range of threading operations—including those too difficult, costly, or impractical by other methods. This machine uses multiple thread cutters with the desired pitch and thread form *but without lead*. Exclusive dial-adjustable sine bar mechanism provides an infinite range of thread leads from 0 to $\frac{1}{4}$ ".

There are no gears or cams to change for different thread leads, so changeover is simplified. Fast, five-minute setup makes the machine ideal for short or long runs. Fully automatic machining cycle plus inherent machine accuracy and simplicity of adjustment eliminates the need for special operator skills. High-quality, consistently uniform threads are readily produced to exacting military and aircraft specifications.

Four standard models handle workpiece length up to 24", 48", 72" and 96". A wide selection of optional attachments is available to speed production and increase the versatility of these machines.

Sine bar adjustment...simple
dial setting...fully automatic cycling
speed production on parts like these



Typical work shown above and below includes a wide variety of parts, such as lock nuts, steering gear worms and nuts, injector cups, aluminum studs, electric motor shafts, jet engine components, etc.



The machines to improve your threading operations are described in a new Sundstrand Bulletin No. 634-1. Write for a copy today.



SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS

Division of SUNDSTRAND CORPORATION



December, 1961

For more data circle No. 906 on Readers' Service Card.

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

Standardize your Machining not your product!

gives you more
FLEXIBILITY
reduces lead time

If you could make your product better, and for less money, on machines which offer complete flexibility in product design, that would be something, wouldn't it?

Today, surface grinders combine these virtues to a greater degree than any other machine tool. This is true, not just on finishing or precision operations, but for a great many stock removal operations as well.

Most pieceparts can be chucked magnetically or held in a pot-type fixture for heavy grinding. You don't have to scrap or modify costly fixtures and special tooling every time you change part specifications or design.

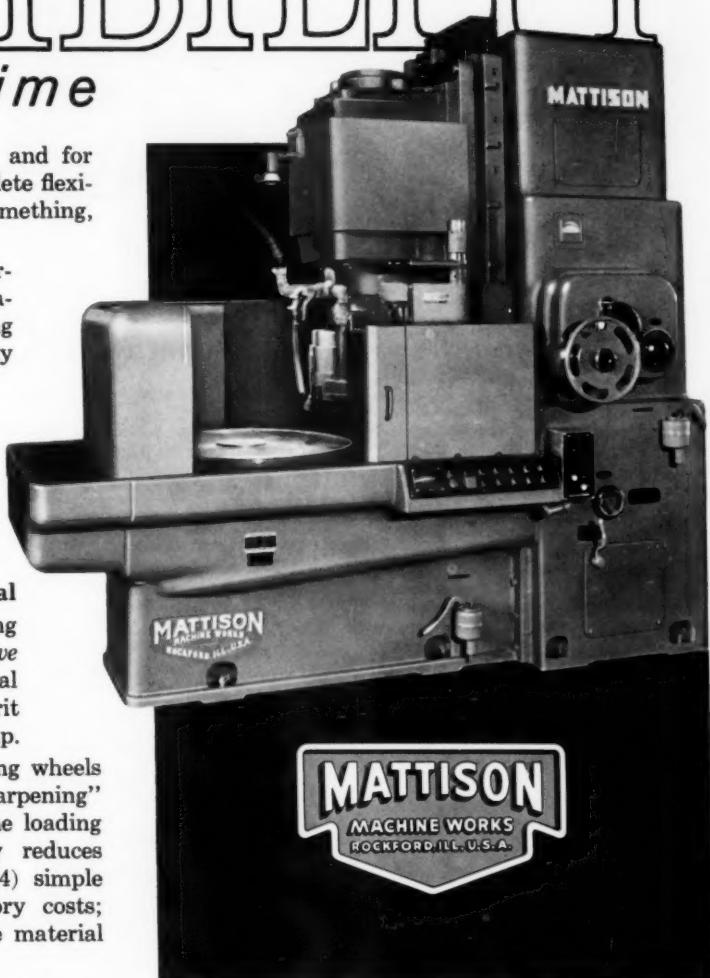
Abrasive machining for stock removal

Surface grinding is not the light cutting operation it was five years ago. *Abrasive machining* is fast, accurate stock removal from the rough, using tough, coarse-grit wheels powered by 100, 150, or even 200 hp.

Economic advantages are: (1) self-dressing wheels minimize wheel changing and "tool-sharpening" costs; (2) magnetic chucks speed machine loading and unloading; (3) increased accuracy reduces checking, inspection, and scrap costs; (4) simple "tool geometry" reduces wheel inventory costs; and (5) reduced stock allowances reduce material and machining costs.

All of these benefits are a reality in many plants, proved beyond question in production-line evaluations. We can show you examples or prove them quickly on *your flat pieceparts* at no cost. Send us your production requirements, blueprints, and sample parts for a test grind in our Methods Lab. Other companies have done it and are now putting heavy stock removal jobs on a Mattison high-powered surface grinder, such as the No. 24 vertical rotary,

ABRASIVE MACHINING
eliminates tooling
and special fixtures



with exclusive Quick-Tilt spindle (shown above). In Mattison's complete line of high-powered surface grinders, for large or small pieceparts, with manual or highly controlled cycle and sizing, there's a significant profit opportunity to *standardize your machining* and make your product line more flexible.

MATTISON MACHINE WORKS
Rockford, Illinois • Phone WO 2-5521

For more data circle No. 907 on Readers' Service Card.

December, 1961

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



CENTERLESS BELT GRINDING



Only centerless abrasive belt grinding gives you these 11 BIG advantages...

- Fast stock removal . . . up to 3 lbs. per minute at feed rates from 2 to 70 feet per minute depending upon application.
- Reverse feed mechanism — through feed grinding in either direction virtually eliminates nonproductive time on reciprocal cycle or multiple-pass work.
- No wheel truing or dressing — low-cost abrasive belt is ideal throw-away tool — requires no balancing, provides constant surface speed.
- Cooler operation — large grinding area and long belt reduces and dissipates heat — less cutting pressure on smaller chips eliminates dimensional distortion.
- Improved cutting action — flexing
- works out chips for better cutting edge exposure
- Interchangeable rubber-covered contact wheel — backs up the belt, eliminates chatter, and compensates for stock irregularities which are difficult to grind with hard wheels.
- Fast Change-over — complete setup takes only minutes, reduces downtime.
- Low initial cost — low installation cost.
- Simple operation — eliminates the need for highly skilled labor.
- Optional automatic size control holds tolerances as close as $\pm .0002"$ T.I.R.
- Built-in coolant system standard on all machines.

Sundstrand-Engelberg machines offer many opportunities for lower cost centerless grinding of cylindrical work. The belt grinding principle provides exceptionally rapid stock removal . . . up to 3 lb per minute. It speeds production because on many jobs it is up to eight times faster than other methods.

Abrasive belt grinding introduces many new economies. Setup and fixturing are simplified. Low cost, flexible belts are the ideal throwaway cutting tool . . . never need truing or dressing and changeover takes only a few minutes.

For tool room, small lot or high production work, Sundstrand-Engelberg centerless abrasive belt grinders cost less to buy, less to install, less to operate . . . and no machine produces finer finishes and accuracies faster or more economically.

Sundstrand-Engelberg centerless abrasive belt grinders are available in 3 to 75-hp models for cylindrical work from 3/32 to 12" in diameter. All machines can be equipped with tandem heads for rough, semifinish, and finish grinding in a single pass.

Precision method for faster stock removal on parts like these



Seamless tubing • Shafting
Rubber hose • Ceramic resistors



Springs • Glass and plastic
rod and tubing • Rotor shafts
Serrated cylindrical parts



Bearing races • Piston rods
Socket wrenches • Atomic fuel
elements • and hundreds of others

The many cost-saving benefits provided by Sundstrand-Engelberg centerless abrasive belt grinders are outlined in a new four-page Bulletin No. 634-2. Write for your copy today.



SUNDSTRAND

SUNDSTRAND MACHINE TOOL

BELVIDERE, ILLINOIS

Division of SUNDSTRAND CORPORATION



December, 1961

For more data circle No. 908 on Readers' Service Card.

CENTER OF MACHINE-TOOL EXCELLENCE

ROCKFORD, ILLINOIS, U.S.A.

A difficult boring and facing problem

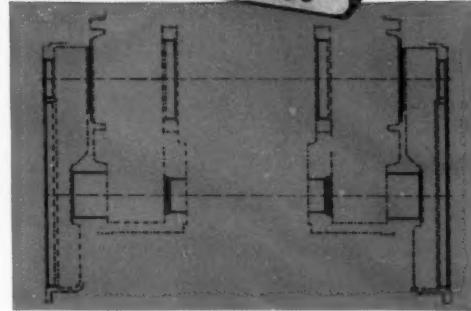
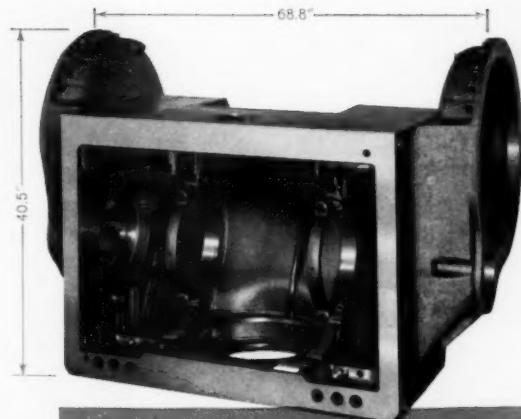
solved by ingenious design...
machine strength and rigidity
...construction accuracy

A number of difficulties had to be overcome in designing and building this machine. Not only was the workpiece constructed of cast-steel and steel weldments, but heavy cuts had to be taken, some larger holes were on the inside, and the bearing caps required firm clamping to prevent springing.

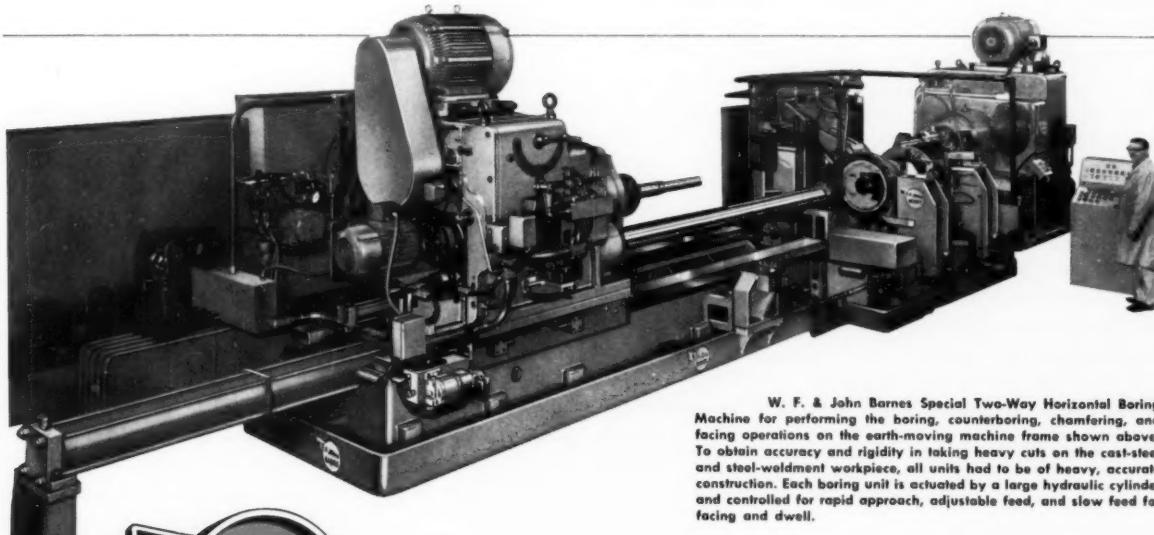
The operations consist of boring, chamfering, counterboring, and facing 12 bores on two shaft centers. These are rough bored, semifinished, and finished without removing the part from the fixture. Provisions had to be made for two sizes of workpieces.

To solve these problems and to obtain the production and the accuracy demanded required know-how of the first order. Quick tool changes were required, feeds in two directions had to be provided for the large boring bar, as well as a drawbar within this bar for feeding out the facing tools in order to face the inside surfaces.

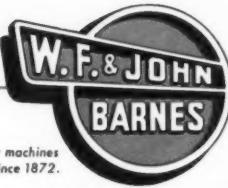
Ingenuity born of experience is required to solve design problems of this kind, and they require capable personnel and production facilities to follow through until the machine is in full production on the customer's floor. You get all of these when you come to W. F. & John Barnes for special machine tools, either large or small. You are invited to take advantage of them.



This rugged workpiece (photo at top), a rear main frame for a large earth-moving machine, consists of cast-steel and steel weldments. It comes to the machine with outside surfaces milled. Made in two sizes, it requires boring, chamfering, counterboring and facing 12 bores on two shaft centers. Solid lines in the schematic drawing show the surfaces to be machined. Note that some larger holes are on the inside, which compounded the difficulties of machining. In addition, the bearing caps on the inside of the frame require clamping to prevent springing. While the over-all width, shown as 68.8", might vary as much as $1/32"$, the depths of the large counterbores had to be held to very close tolerances.



W. F. & John Barnes Special Two-Way Horizontal Boring Machine for performing the boring, counterboring, chamfering, and facing operations on the earth-moving machine frame shown above. To obtain accuracy and rigidity in taking heavy cuts on the cast-steel and steel-weldment workpiece, all units had to be of heavy, accurate construction. Each boring unit is actuated by a large hydraulic cylinder and controlled for rapid approach, adjustable feed, and slow feed for facing and dwell.



Builders of better machines
since 1872.

Barnes Engineers are always ready to work with you. Write for descriptive literature.

W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET • ROCKFORD, ILLINOIS



MULTIPLE-SPINDLE DRILLING • BORING • TAPPING MACHINES — AUTOMATIC PROGRESS-THRU TRANSFER-TYPE MACHINES

For more data circle No. 909 on Readers' Service Card.

December, 1961

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**





New Economics of

Big money being wasted because of traditional concepts in lathe utilization can now be saved.

The two jobs illustrated, taken from the same lathe department, prove that Barber-Colman's new 1610 "specialist" lathe—for turning, facing, and boring—is an economically sound machine concept for almost any shop.

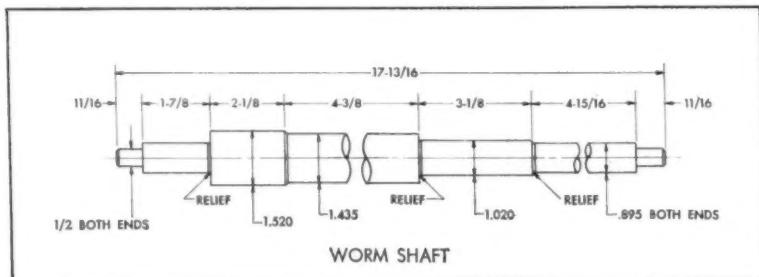
Elimination of threading equipment—features which are not fully utilized on many lathes—produces an initial cost saving that can pay for a hydraulic tracer. The manufacturer of these parts (below) had

plenty of threading capacity on older machines, so he elected to take a valuable hydraulic tracer for the cost of threading equipment he really didn't need.

Of course, there are many operating benefits to be gained. Spindle speed and power feed to both carriage and cross slide are infinitely variable. Ability to change both speeds and feeds without stopping the machine increases production on a great many jobs. Over-all result: A new kind of lathe specialization that minimizes capital investment for certain classes of work and opens a valuable opportunity to improve

total machine utilization. Here are some of the specific results this manufacturer achieved.

The worm shaft was shifted from a turret lathe to the tracer-equipped Barber-Colman 1610 for facing, center drilling, and turning. Threads are now cut on a threading machine. This shift reduced total cutting time 32% and setup time 12% (including time on a threading machine). But time on a machine has to be reckoned in dollars, not minutes. Capital investment in the turret lathe is much more than for the 1610 lathe. What's more, the operator of the turret lathe is a Class



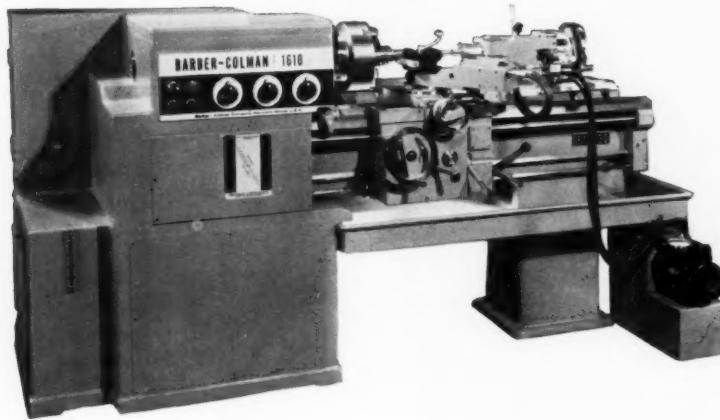
December, 1961

For more data circle No. 910 on Readers' Service Card.

MACHINES DESIGNED TO MEET YOUR NEEDS

ROCKFORD, ILLINOIS, U.S.A.

**Report shows how one Barber-Colman
turning lathe initiated important methods
improvements throughout a department.**



"Specialist" Lathes

A, while the operator of the 1610 is Class B. And to further prove how ultimately practical this new lathe is, the Class B operator not only turns out more work, he also scraps fewer parts.

Utilization: tracer vs threading
Perhaps you are in the same position as this manufacturer: You have enough lathes to handle your threading requirements, but not sufficient tracing capacity. If so, a 1610 with tracer will be a particularly profitable investment for you. Take this hob arbor as an example.

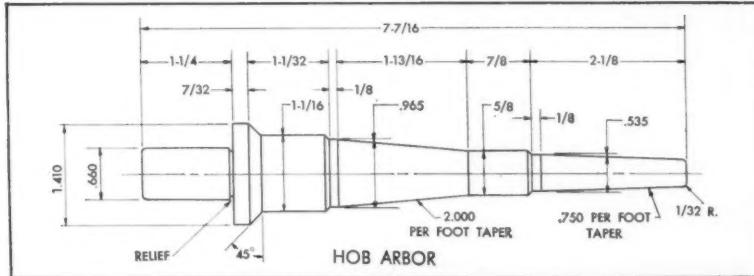
By shifting the job from a con-

ventional lathe without tracer to a tracer-equipped 1610, production was increased over 100%—from 1.5 to 3.3 pieces per hour. Setup time was reduced 40%. The important point is, this manufacturer is now using both his old lathes and his new machine more profitably. Here's why.

Maximum cutting speed on the old lathe was 632 rpm and feed was .0092" per revolution. On the 1610 FT, speed ranges from 900 to 1500 rpm and feed is .015" per revolution. A load meter allows the operator to obtain maximum production. In other words, there's quite a difference in capacity be-

tween an old lathe and a modern lathe. And since threading normally requires *slow speeds*, doesn't it make sense to thread on your older machines—and do turning, facing, and boring operations on this high-speed "specialist"? Why put low-speed work on a high-speed lathe?

The 1610, with 16" or 20" swing and 6½ hp motor, is a precision lathe capable of turning out toolroom quality work. If you are in the market for a new lathe, phone your Barber-Colman representative or write us for descriptive literature and complete specifications. Ask for Bulletin No. 9061-1.



For more data circle No. 910 on Readers' Service Card.

December, 1961



122 Loomis St., Rockford, Illinois



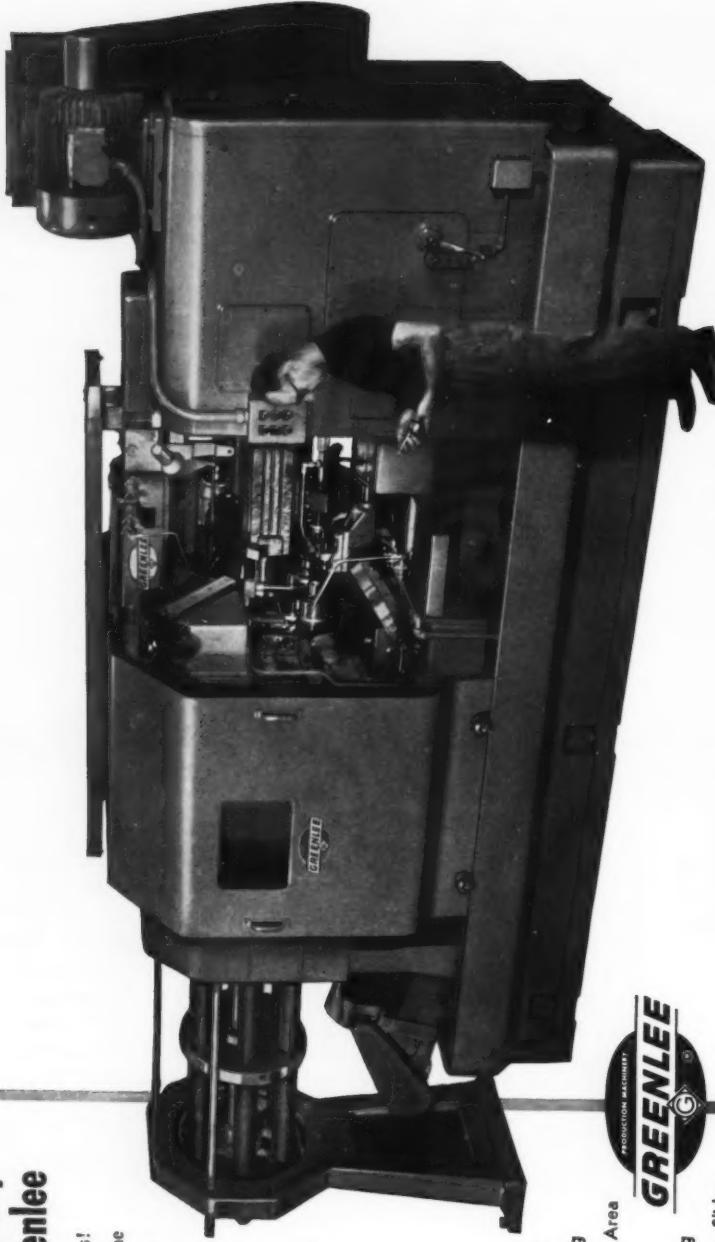
Now ••• 3½" Capacity With This New Greenlee

Biggest of the Greenlee Bar Automatics!

This new 3½" — 6 spindle model offers the most outstanding advantages in the field. It is exceptionally versatile. It offers well-known Greenlee dependability.

Like all Greenlee Automatics it has independent, cam-operated cross slides and a wide-open tooling area. Greater flexibility, accuracy and productivity are built into this big, powerful Greenlee Automatic. Check these outstanding advantages:

- Permanently Aligned Spindle Carrier
- Positive, High-Speed Carrier Indexing
- Wide-Open, Easily Reached Tooling Area
- Sturdy, Cam-Feed Main Tool Slide
- Interchangeable Cross Slide Camming
- Micrometer Adjustment On All Cross Slides
- Rapid-Shift, Dual-Range Speed and Feed Gears
- Built-in Lead Screw Threading Feed and Drive



For more data circle No. 911 on Readers' Service Card.



MACHINES DESIGNED TO MEET YOUR NEEDS

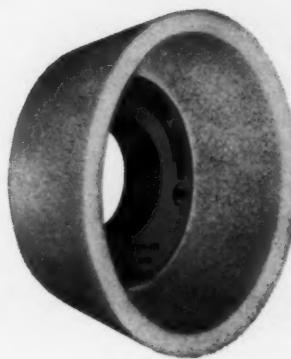
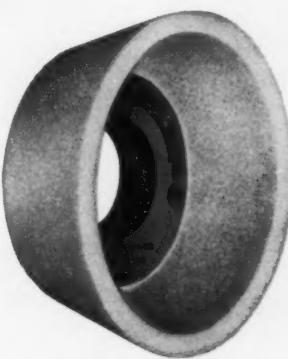
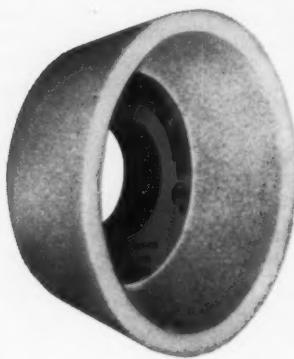
ROCKFORD, ILLINOIS, U.S.A.

Other Greenlee 6 Spindle Bar Automatics
are offered in 1", 1½", 2" and 2½" capacities.

TRANSFER MACHINES • SPECIAL MACHINES • SIX AND FOUR SPINDLE AUTOMATICS • TRIM PRESSES • DIE CASTING MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC AND HAND TOOLS



POSITIVE DUPLICATION—EVERY TIME!



Music to please you is identically reproduced by these three hi-fi records pressed from the same master recording. The three toolroom grinding wheels (above) will also please you with their masterly Positive Duplication. That's because they are CINCINNATI® GRINDING WHEELS.

FAMOUS, UNIQUE (PD) PROCESS

Unique in the industry, the famous Cincinnati® manufacturing process is governed by 36 unvarying quality control steps. Print-weigh tickets, for example, must match the weights for every mix—*exactly* as specified on the Master Card which controls every operation in the rigid procedure.

UNIFORM, PREDICTABLE PERFORMANCE

This extraordinary attention to manufacturing detail results in wheels of unsurpassed uniformity.

You can reorder CINCINNATI WHEELS with confidence, because they give you the same good job time after time after time. You use fewer ® wheels because they last longer.

CALL CINCINNATI TODAY

Factory trained by the Cincinnati Milling Machine Company, our grinding specialists are available to you for consultation on all your grinding problems. Call your CINCINNATI GRINDING WHEELS Distributor, or contact us direct, Cincinnati Milling Products Division, Cincinnati 9, Ohio.



POSITIVE DUPLICATION



®Trade Mark Reg. U.S. Pat. Off.

How to cut your disposable-tooling costs by 30 per cent at no sacrifice in quality or output. (Answer is on the next page.)



With the new Carb-O-Lock toolholder-insert combination. The single most important advance in the whole history of metal-cutting.

Save 30 per cent when you buy it. Save 40 per cent when you use it.

These are minimums. Users of the Carboloy Carb-O-Lock toolholder-insert combination have reported savings many times higher. Why?

Simple. The Carb-O-Lock design is simple. Using a cam-action locking principle, the Carb-O-Lock has just three parts (not including insert). Insert changing and indexing is a breeze; parts inventories can be held to absolute minimums. Streamlined design lets you bring the toolholder closer to your work. And less overhang means less vibration, less insert chipping and breaking.

Plus: the Carb-O-Lock gives you proven performance. A major diesel engine manufacturer discovered Carb-O-Lock allowed nearly triple the feed, eliminating two machines. A locomotive and car equipment company found Carb-O-Lock's simple, rugged design reduced time for tool changes and permitted maximum horsepower utilization.*

Carb-O-Lock inserts are available now in Grade 883 for machining cast iron, as well as many operations on

the following materials: high-temperature alloys, type 300 stainless steel, brass, bronze.

So start your savings program today. Phone your Authorized Carboloy Distributor and order your Carb-O-Lock toolholder-insert combination. Save 30 per cent. And more.

Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Street, Detroit 32, Michigan.

*Case histories available on request

CARBOLOY
CEMENTED CARBIDES
METALLURGICAL PRODUCTS DEPARTMENT
GENERAL ELECTRIC

CARBOLOY CEMENTED CARBIDE BLANKS AND DISPOSABLE INSERTS
• BRAZED TOOLS • TOOLHOLDERS • CARBIDE DIES • WEAR PARTS

WALKER CERAMAX



TURNING

Walker, for the first time in machine tool history, offers safe magnetic holding for lathes. Ceramic magnets in Walker Rotary CERAMAX chucks are not subject to electrical power failure and have three times greater coercive force than ordinary Alnico magnets. With uniform holding power over the entire face of the chuck, safe, accurate turning, facing or trepanning is accomplished in a single set-up.

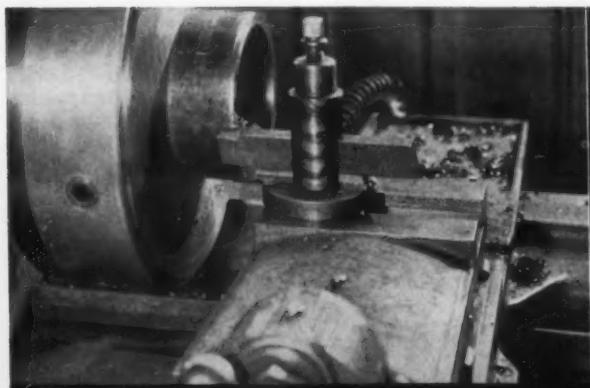
*For dependable, trouble free operation
specify Walker CERAMAX Chucks.*

GRINDING

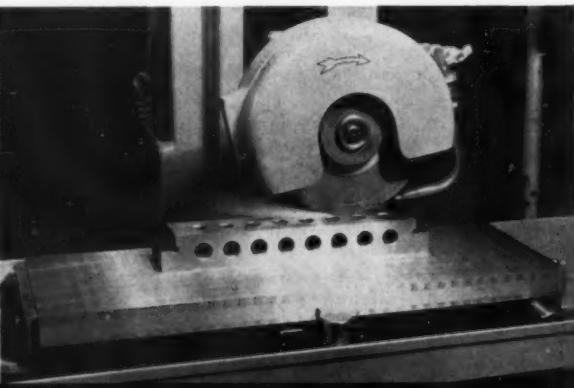
Walker CERAMAX chucks provide all the holding power needed for standard grinding operations and with fine pole divisions are ideal for thin, small work as well as large, heavy pieces. All-steel top plate minimizes redressing to reduce non-productive machine time. Ceramic magnets retain magnetism permanently, eliminate constant recharging.

O.S. Walker Co., Inc.
ROCKDALE ST. • WORCESTER 6, MASS.

Original Designers and Builders of Magnetic Chucks

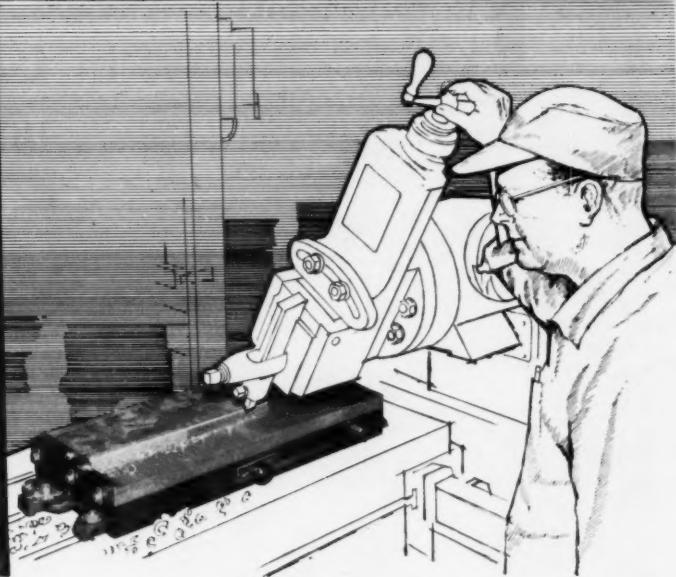
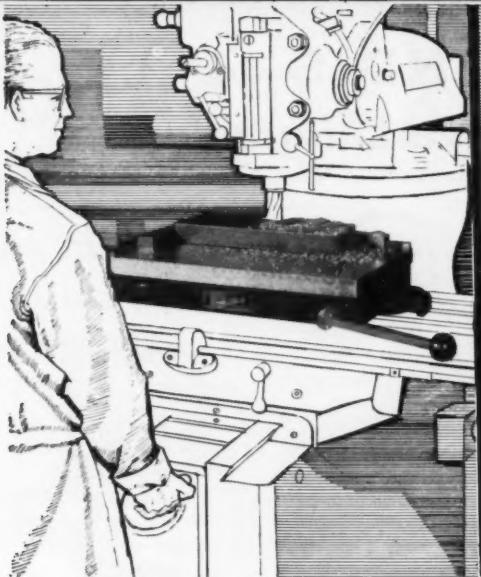


Turning a steel sleeve with a Walker Ceramax Chuck



Precision grinding on a Walker CERAMAX chuck

MAGNETIC CHUCKS



MILLING

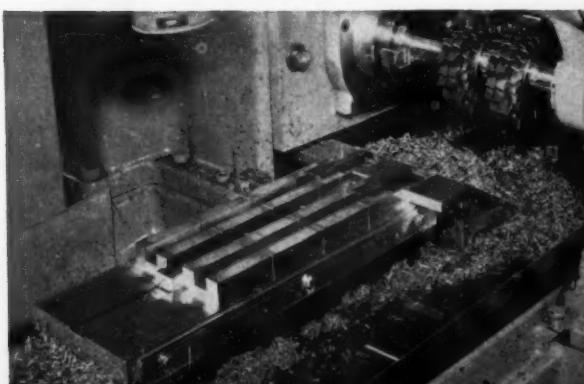
Walker CERAMAX Chucks eliminate tedious clamping in many milling operations. Only an auxiliary end stop to take the thrust on the table is needed for extra heavy cuts. Power-packed ceramic magnets individually magnetize each pole. Focused flux keeps the magnetic force down near the top plate and away from the spindle. Controlled magnetism from alternating north and south poles actually exerts a demagnetizing influence on the cutter. Tools remain chip-free.

SHAPING

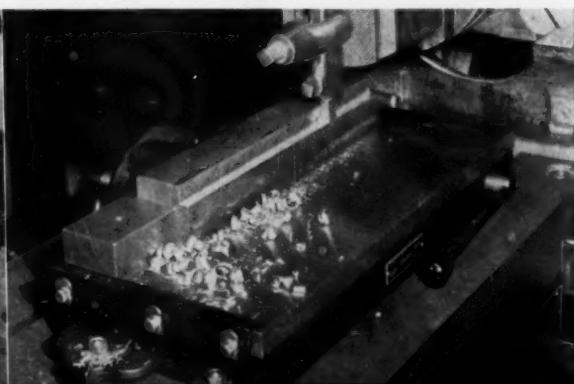
Walker CERAMAX Chucks reduce machine down time and speed production in many shaping, profiling, broaching and planing operations. Extraordinary resistance to sliding force results from coercive force exerted by the fine pole divisions of permanent ceramic magnet chucks.

Check your plant for the many cost saving applications possible with Walker CERAMAX chucks.

O.S. Walker Co., Inc.
ROCKDALE ST. • WORCESTER 6, MASS.
Original Designers and Builders of Magnetic Chucks



Walker CERAMAX chuck holds eight pieces for gang milling



A Walker Ceramax Chuck holds steel pieces during shaping operation.

MARLIN-ROCKWELL RELIABILITY COUNTS in LANDIS 14" LR universal grinders



MRC Super-Precision Ball Bearings contribute to the reliability and accuracy of the all new Landis 14" LR Universal Grinders.

These bearings are used in the headstock and wheel feed — in this, the most accurate grinder ever produced by Landis Tool Company for medium production runs, as well as tool work.

BACKED BY 63 YEARS EXPERIENCE

Consult OUR Engineering Department on YOUR Bearing Problems

MARLIN - ROCKWELL CORPORATION

Executive Offices: Jamestown, N. Y.

MRC
BALL AND ROLLER
bearings

DURAFLEX

**the more durable, ductile,
flexible phosphor bronze—
at no extra cost**

Here is one of the most versatile of phosphor bronzes. The superfine-grain structure of Duraflex provides a considerable improvement in fatigue life over regular phosphor bronze. Now you can obtain higher endurance limits with greater formability. It's ductile. It's resilient. It's corrosion-resistant!

This new, higher quality Anaconda phosphor bronze is now available in several standard phosphor bronze alloys—in strip metal up to 0.062" thick and up to 14" wide in all standard tempers, and in wire up to $\frac{3}{16}$ " diameter. Duraflex strip is also available in long rolls.

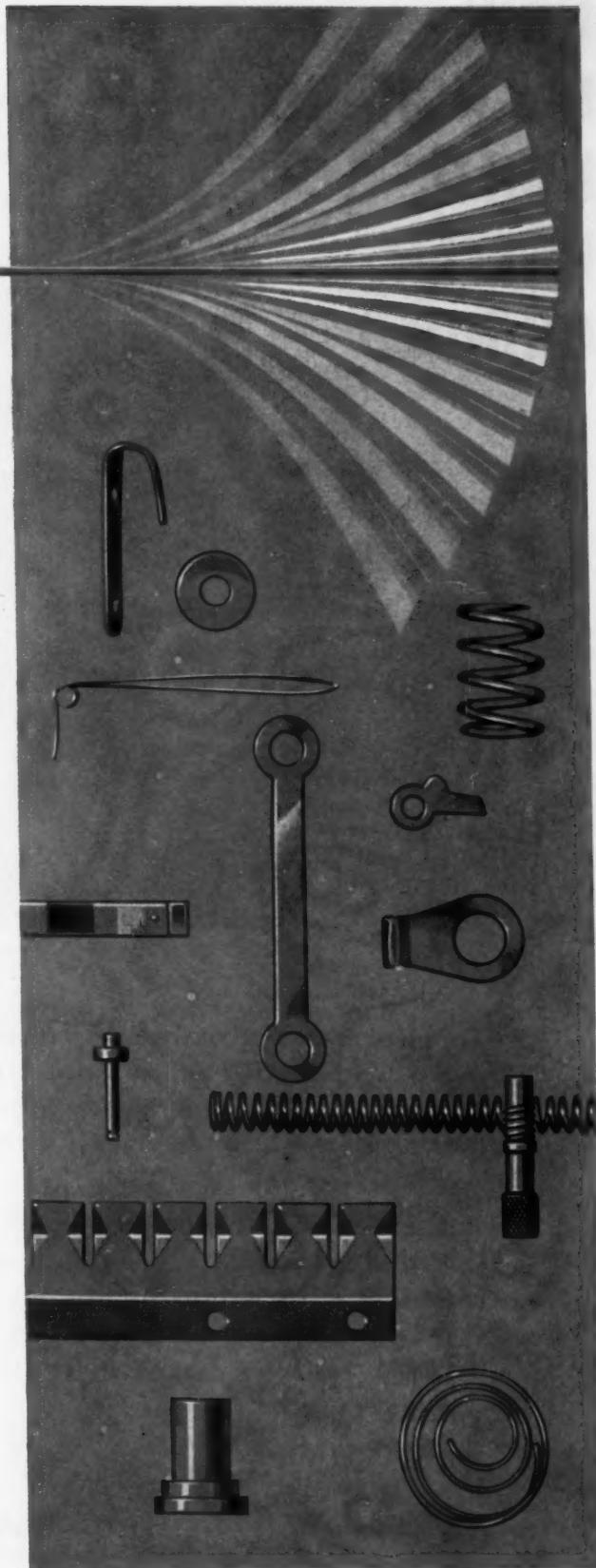
Within the capabilities of size and alloy composition, Duraflex strip and wire can be applied to the innumerable uses for which conventional phosphor bronzes are employed, and in most instances provide longer and more efficient service. Yet Duraflex sells for the same price as regular phosphor bronze in the same alloys and forms.

Publication B-38 tells the story. Write for your copy—or for any assistance from our Metallurgical Dept. in selecting the proper alloys for your metal-working projects. Address: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 61-1148

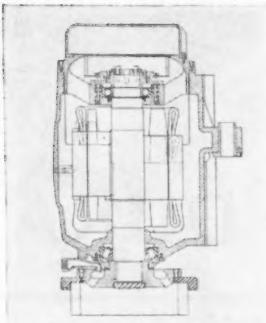
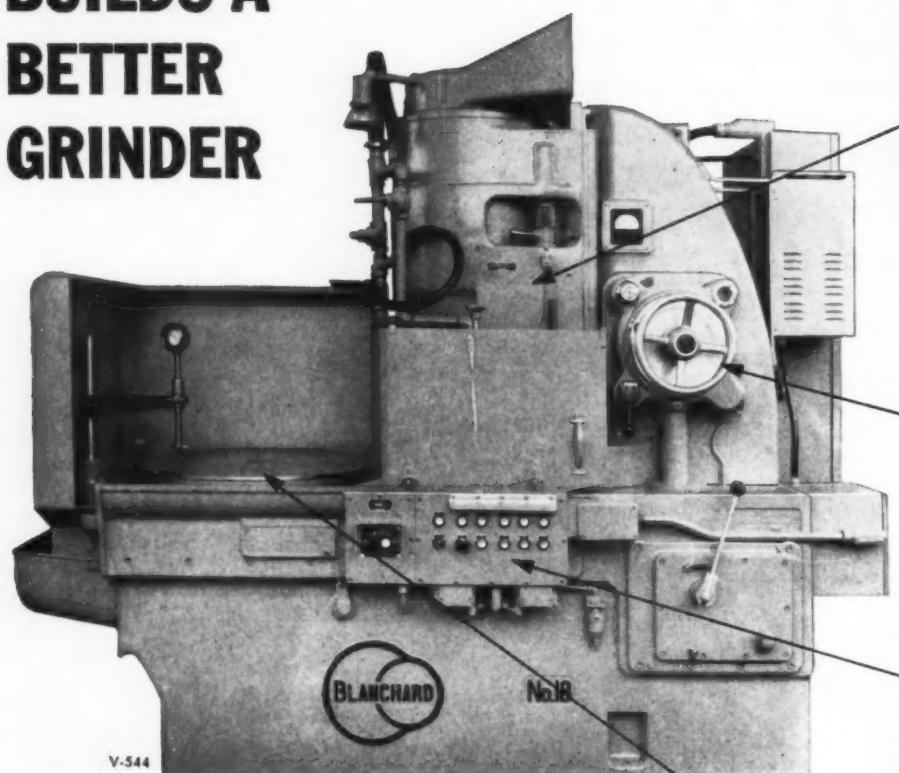
DURAFLEX®

A product of

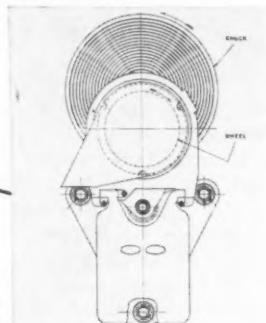
ANACONDA®
AMERICAN BRASS COMPANY



HOW BLANCHARD BUILDS A BETTER GRINDER



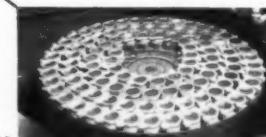
SPINDLE... incorporates a superior, pre-loaded anti-friction bearing system that removes all backlash and radial play. Integral "balanced" mounting of rotor on spindle eliminates vibration.



WHEEL HEAD COLUMN... is of heavy box-section design for extra rigidity... supported at 3 widely-spaced points. Column may be easily adjusted for alignment. Special column tilting devices available to produce concave or convex surfaces.



V-541
GRINDER CONTROL... is compact and conveniently located for fatigue-free handling. All control panels are BLANCHARD manufactured for troublefree operation.



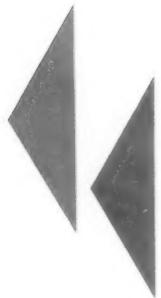
W-949
MAGNETIC CHUCK... provides maximum useful magnetic surface... has such closely spaced poles, that work as small as a quarter will always touch two or more.

There's no mystery about the *better* performance you get with a BLANCHARD Surface Grinder. It's simply a matter of *better* design of each individual machine part. For example, look at just 4 features of the No. 18, shown at the right.

Get complete details on all 24 models of BLANCHARD grinders. They're today's leading high precision, high production grinders on materials ranging from carbon to quartz... from bronze to steel. You can handle parts ranging from tiny jewels to giant plates up to 108" across corners.

PUT IT ON THE  **THE BLANCHARD MACHINE COMPANY**
64 State Street, Cambridge 39, Massachusetts

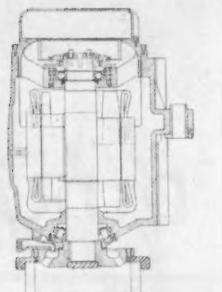
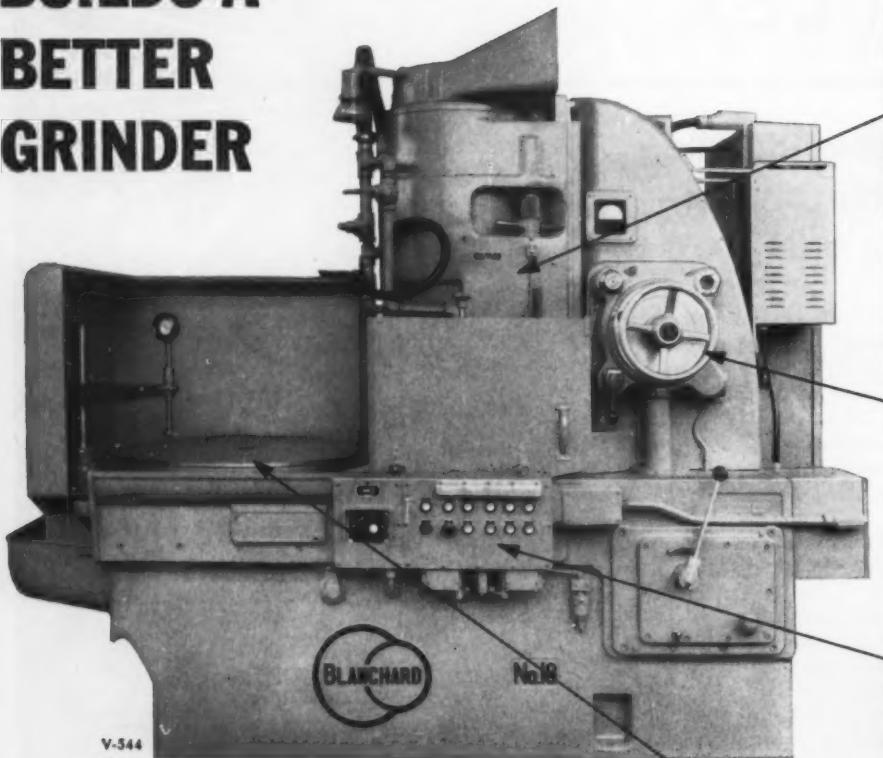
In any language...
Clearing presses are
the way to more
efficient mass production



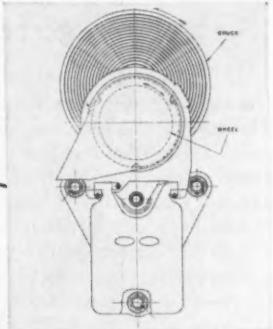
here is the story

アリヤリラブ・プレスで
生産の飛躍

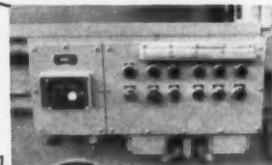
HOW BLANCHARD BUILDS A BETTER GRINDER



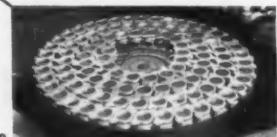
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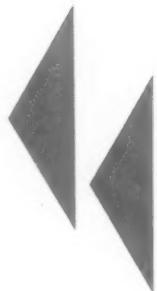
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PUT IT ON THE  **THE BLANCHARD MACHINE COMPANY**

64 State Street, Cambridge 39, Massachusetts

In any language...
Clearing presses are
the way to more
efficient mass production



here is the story

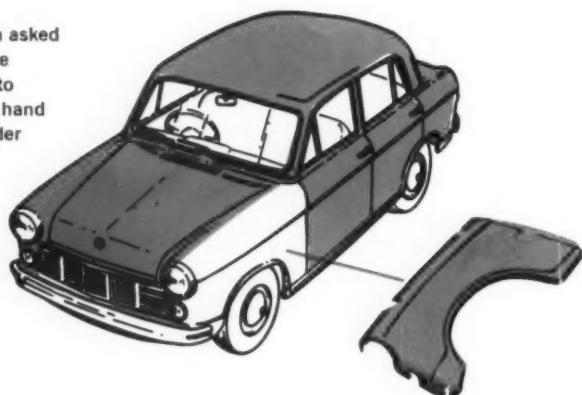
クリヤリーラ・プレスで
生産の飛躍

WE WERE
ASKED TO
TACKLE THIS
PROBLEM



Our engineers started
from drawings of the fender
and fender extension
shown here.

A leading automotive
manufacturer in Japan asked
Clearing to propose the
equipment necessary to
produce right and left hand
front fenders and fender
extensions.





How best to do the job? What type of presses? What type of in process handling equipment? These problems were tackled by Clearing's plans engineering group.



CLEARING



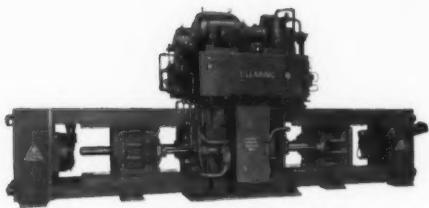
Bottom Drive, multiple



Straight Side Mechanism



... Drive, multiple action



Special purpose equipment



Column-Type Hydraulic

usi[®] Clearing

DIVISION OF U.S. INDUSTRIES, INC.
6499 W. 65th Street, Chicago 38, Illinois

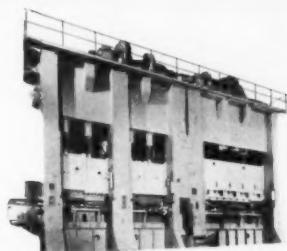
Clearing builds all types of press equipment from 22 tons upward. Whatever the problem, let Clearing recommend the equipment that is best for you.



Straight Side Mechanical



Open Back Inclinable

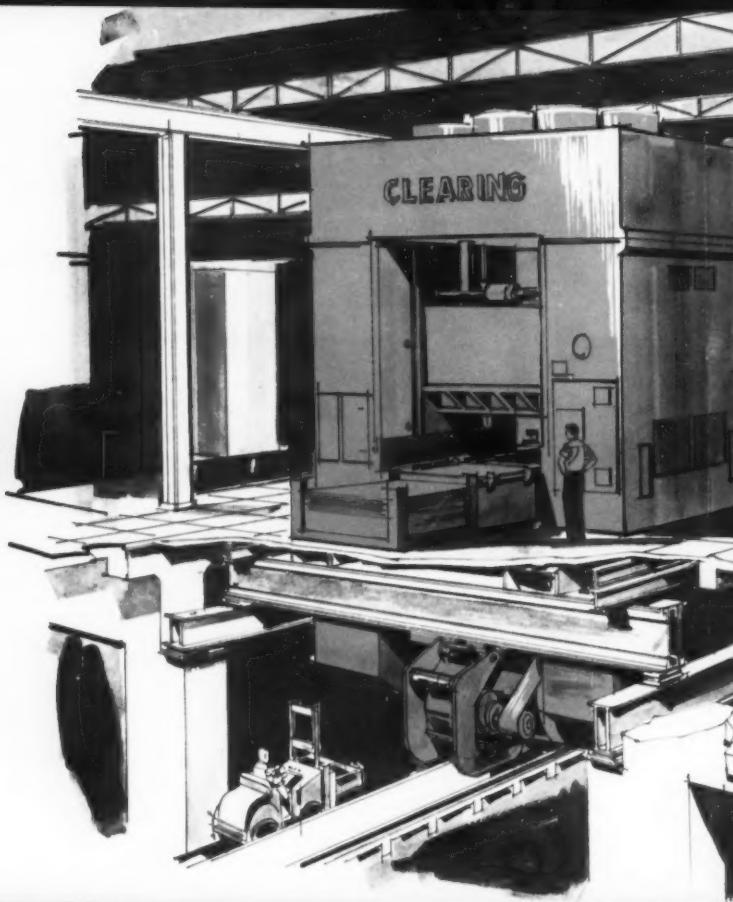


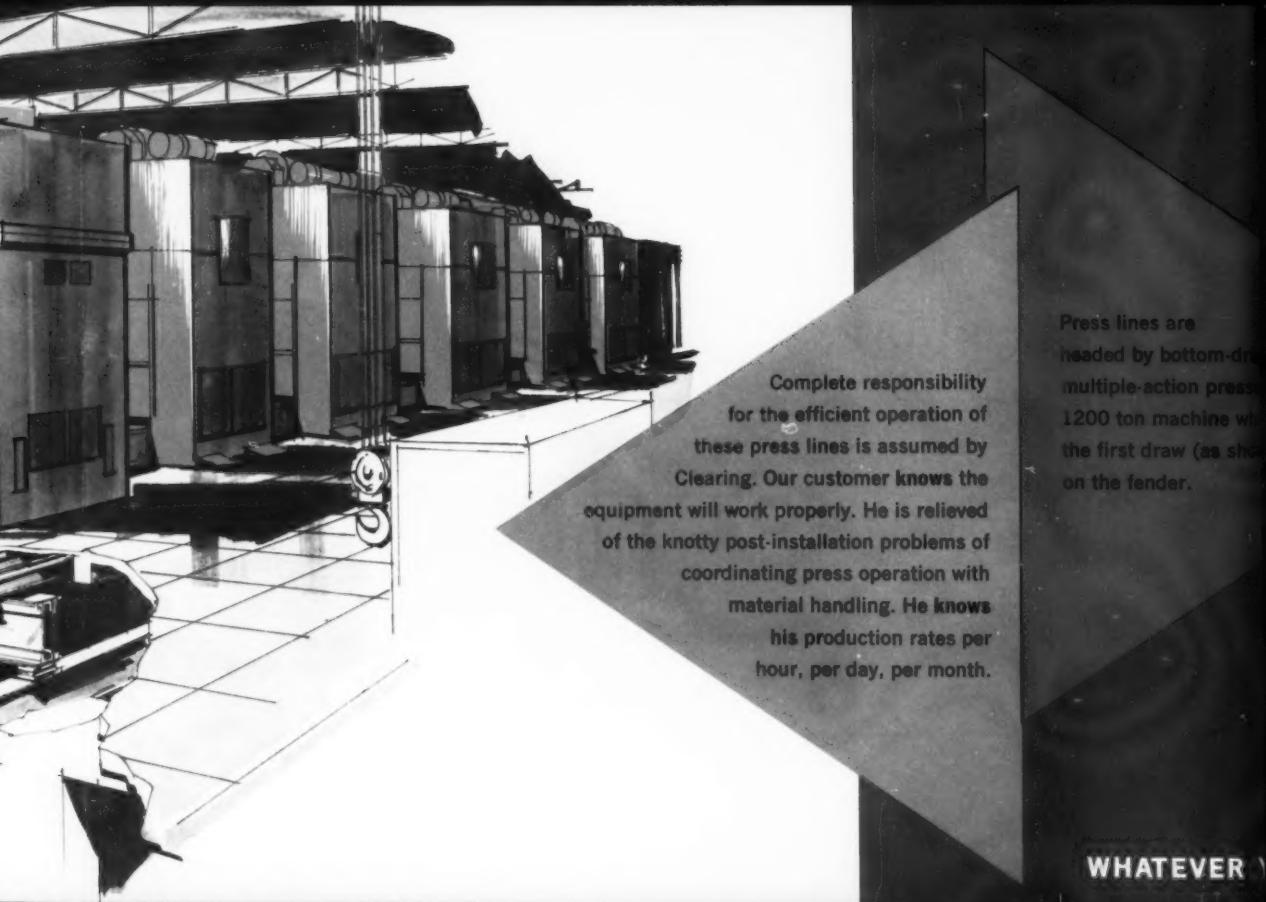
Automated Transfer Presses

**and this
is the
result**

our press lines like
this one... including material
handling, automation equipment
and dies. The entire system
is tested on Clearing's
assembly floor.

**run, tried and
proved before
delivery**



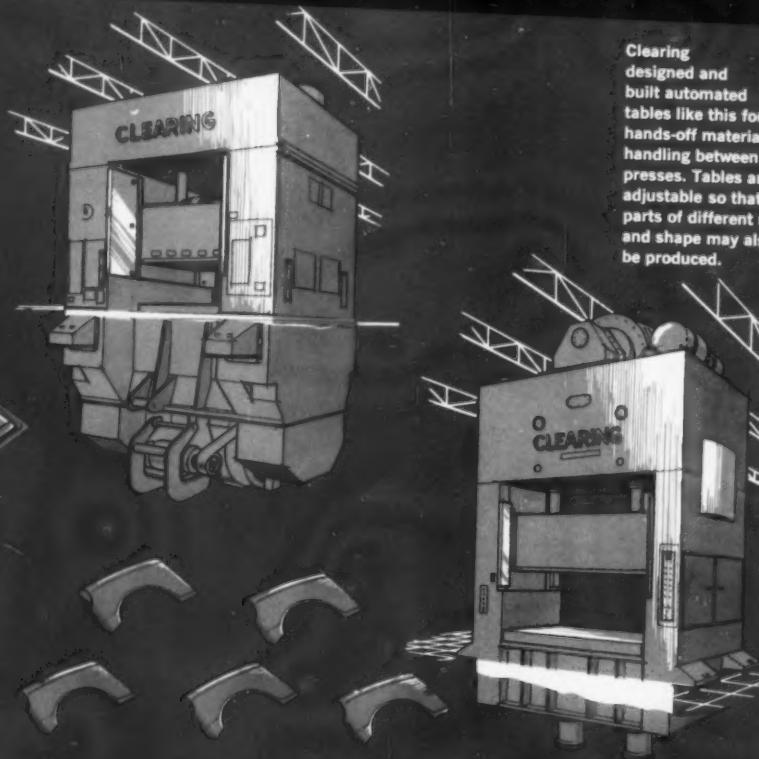


Complete responsibility
for the efficient operation of
these press lines is assumed by
Clearing. Our customer knows the
equipment will work properly. He is relieved
of the knotty post-installation problems of
coordinating press operation with
material handling. He knows
his production rates per
hour, per day, per month.

Press lines are
headed by bottom-draw
multiple-action press
1200 ton machine with
the first draw (as shown)
on the fender.

WHATEVER

Clearing designed and built automated tables like this for hands-off material handling between presses. Tables are adjustable so that parts of different size and shape may all be produced.

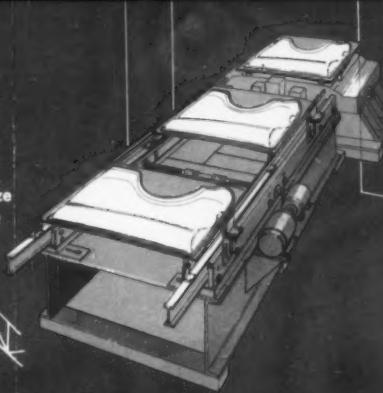


Press lines are headed by bottom-drive, multiple-action presses like this 1200 ton machine which performs the first draw (as shown) on the fender.

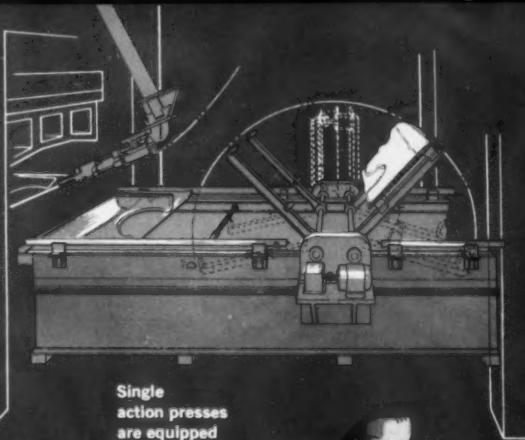
Follow-up operations are performed by Clearing straight side single action presses like the 500 ton machine shown at right. The press lines suggested for producing fender extensions are somewhat lower in capacity.

WHATEVER YOUR PRODUCTION NEEDS . . . AN O.B.I. OR AN ENTIRE MANUFACTURING S

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automated
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able so that
of different size
shape may also
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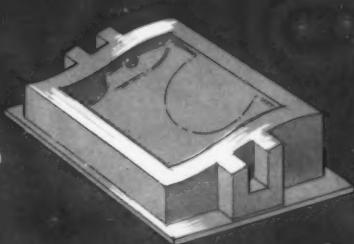


A mechanical unloading arm removes the piece-part after first draw. The part is automatically inverted by this turnover device so that the part goes into follow-up presses right side up.



Single action presses are equipped with the famous Clearing Tornadyne Clutches. Dual speed clutches cut cycling time on multiple action presses.

Responsibility for the fender dies is assumed by Clearing. The dies are designed and built while the presses are being constructed. At target date, the entire system is ready for swift, efficient, profitable production.



All presses have Clearing's automatic oil lubrication system and many other Clearing exclusive design features.



URING SYSTEM, LET CLEARING ENGINEERS HELP YOU FIND A BETTER WAY

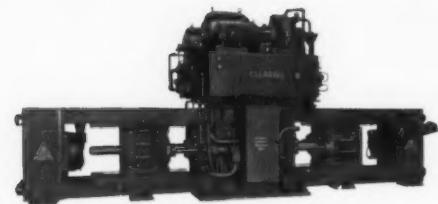


Bottom Drive, multiple action

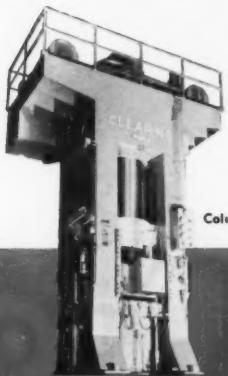


Straight Side Mechanical

Clearing builds all types
the problem, let Clear-



Special purpose equipment

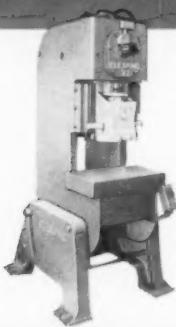


Column-Type Hydraulic

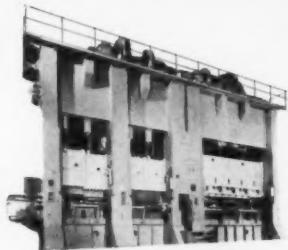
usi[®] Clearing

DIVISION OF U.S. INDUSTRIES, INC.
6499 W. 65th Street, Chicago 38, Illinois

Builds all types of press equipment from 22 tons upward. Whatever
you need, let Clearing recommend the equipment that is best for you.



Open Back Inclinable



Automated Transfer Presses



98% "UP-TIME"

WITH HUGHES NUMERICAL CONTROLS

Hughes Numerical Controls can help keep your up-time extremely high. In fact, customers report down-time of as little as 2% of productive time after thousands of hours in operation. (Ask any company that uses Hughes Numerical Controls.*.) The reason: HUGHES RELIABILITY. Hughes' electronic engineering know-how combines transistorized circuitry, modular construction and photo-electric tape readers to achieve true RELIABILITY. This means lower operating costs, greater productivity

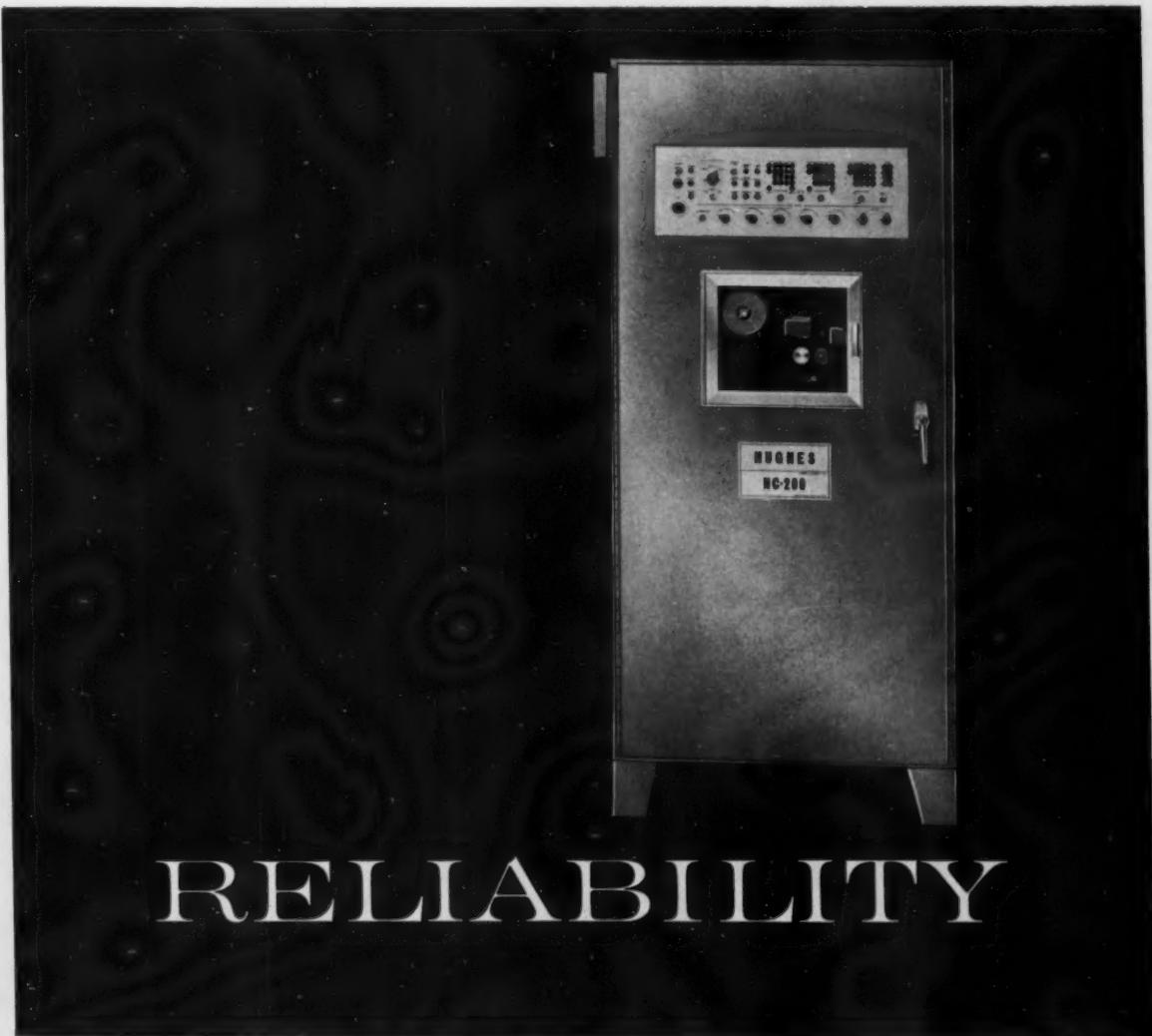
and higher profits to you. If you can't afford down-time, get the facts. Find out more about RELIABLE Hughes Numerical Controls. Write, wire teletype (INGL 4117) or call direct: Hughes Industrial Control Systems, Dept. No. 92-21, P.O. Box 90904, Los Angeles 9, California.

*List of companies in your area using Hughes Numerical Controls supplied on request.

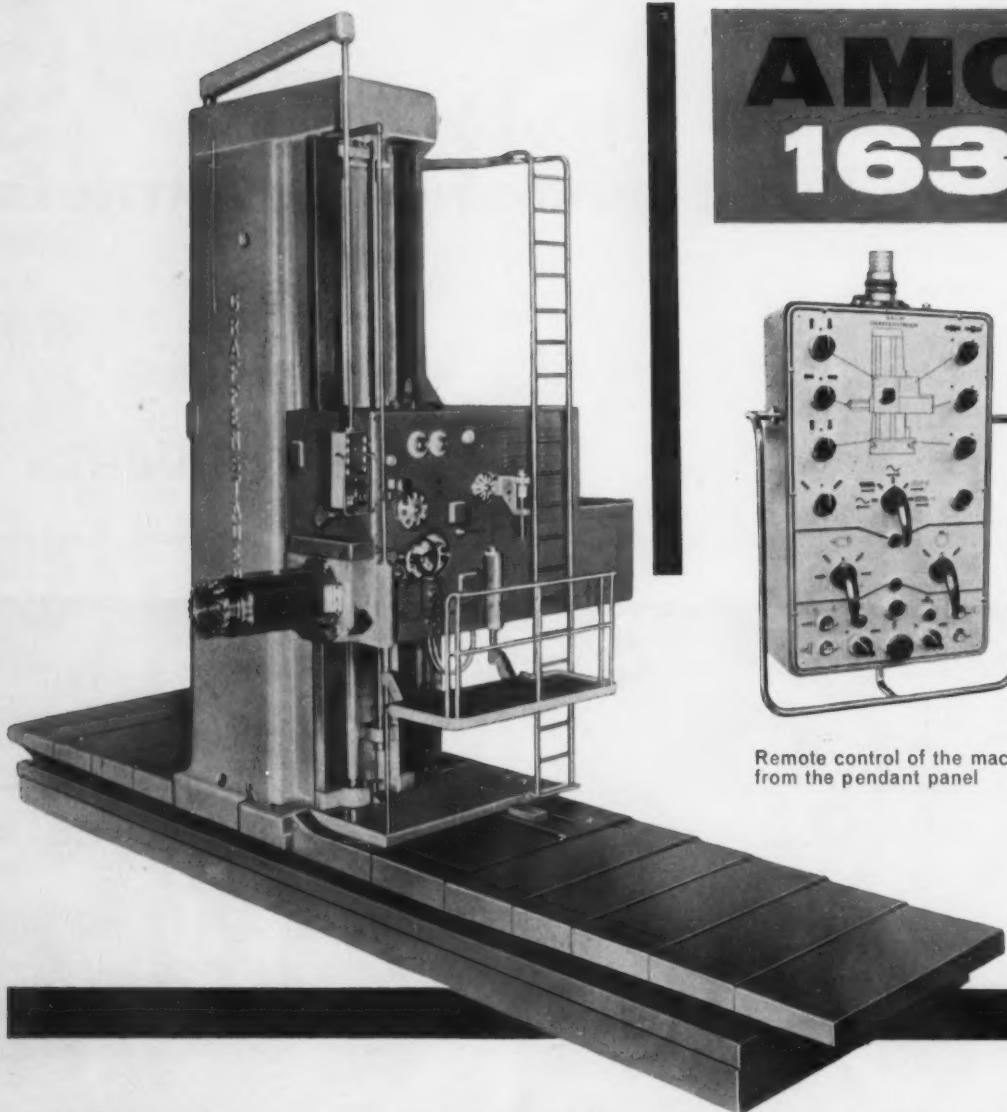
CREATING A NEW WORLD WITH ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
INDUSTRIAL SYSTEMS DIVISION



RELIABILITY



Remote control of the machine
from the pendant panel

other products

universal combination millers • knee-type milling machines • base-type milling machines • bed type milling machines • planer type milling machines • horizontal boring and milling machines • ram type milling and boring machines • single column boring mills • radial drills • spécial purpose machines.

MILLING AND BORING MACHINE with octagonal sliding ram

Dimensions of the octagonal sliding ram	390 x 417 mm (15.35 x 16.4")
Spindle diameter	160 mm (6.3")
Vertical traverse of headstock	2.500 mm (98.5")
Power of main motor	45 HP
Approximate nett weight	46,5 Tons

GRAFFENSTADEN

Société
Alsacienne de
Constructions
Mécaniques

Graffenstaden Works - Bas-Rhin (France) 156, Route de Lyon
Télégrams : MECALSAC - Illkirch-Graffenstaden Telex : N° 87054
For more information, write to : S.A.C.M.,
3 Channing Place CAMBRIDGE, 38, Mass. Tel. EL 4.8043

This well-known manufacturer depends on . . .
A BANK OF THOMPSON GRINDERS

. . . for a tough production job.



THOMPSON RAMO WOOLDRIDGE INC. picks
Thompson Grinders for accuracy,
dependability and speed.

All the Thompson machines shown above in one bank are grinding jet aircraft engine compressor vanes. Each of the 5 surfaces on the root end as well as the concave and convex airfoil surfaces on the lug end are ground to extreme accuracy on the stainless steel forgings.

For the five years that these Thompson machines have been steadily on this job, downtime and maintenance costs have been negligible factors.

Put your toughest production job on a Thompson grinder and watch it cut your costs, speed your production and improve your product.

THE THOMPSON GRINDER CO., Springfield, Ohio

"Keep **Thompson** in mind for that daily grind"

Thompson
SURFACE
GRINDERS

PLENTY OF PUSH

in a small package

**STRIPPIT HYDRA SPRINGS
DELIVER 600% MORE FORCE**



STRIPPIT Hydra Springs, using compressible liquids, develop up to 600% more force than mechanical springs of comparable size. Six standard models develop forces from 2,200 lbs. to 8,500 lbs. and operate with strokes ranging from $\frac{1}{4}$ " to $1\frac{1}{2}$ ". Spring rates run from 2,200 lbs. to 32,000 lbs./in.



STRIPPIT Hydra Springs' high spring force, instant action and compact size make them ideal components in many installations where space is at a premium. Typical applications include uses with dies, perforating equipment, machine tools and plastic injection dies, cable tensioning devices, retarding mechanisms.



STRIPPIT Hydra Springs use STRIPPIT Comproils. Changes in the type or volume of Comproils vary and adjust the loads of the Hydra Springs to meet required forces of individual applications. In addition, a force adjuster for critical pressure adjustments is provided on all Hydra Springs except Model 38K11.



STRIPPIT Hydra Spring applications are so varied that, in addition to the standard models, STRIPPIT's engineers can custom design and fabricate special Hydra Springs to solve your problem. A call to your STRIPPIT Tool & Methods Engineer will bring immediate help. If you prefer, write for Catalog K.

WALES **STRIPPIT** INC.

203 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario
In Continental Europe: Raskin, S.A., Lausanne, Switzerland In the British Isles: Kearney & Trecker—C.V.A. Ltd., Hove, Sussex, England





TOO SLOW ?

Emphatically not! . . . ask any visitor to the 1960 Machine Tool Exposition who watched a Marvel No. 6 Hack Saw Machine cut-off 3½" diameter 1018 steel in 27 seconds! This Saw, costing less than \$3000, was actually cutting at the rate of 18 square inches per minute!

We made the above demonstration merely to "match" what we believe to be the impractical demonstrations of some of our competitors. OUR visitors were warned that continuous cutting at this speed is economically impractical if maximum blade life and accuracy (after the first 20 cuts) are desired. They were told that the material could be cut day in and day out, at the rate of 8 square inches per minute with tool cost of approximately 1 cent per cut.

Our point? Marvel No. 6 and No. 9 Series Heavy Duty Ball Bearing Hack Saw Machines, as we build them today, have speed to spare. And they offer the most accurate, economical cut-off at the lowest initial investment.

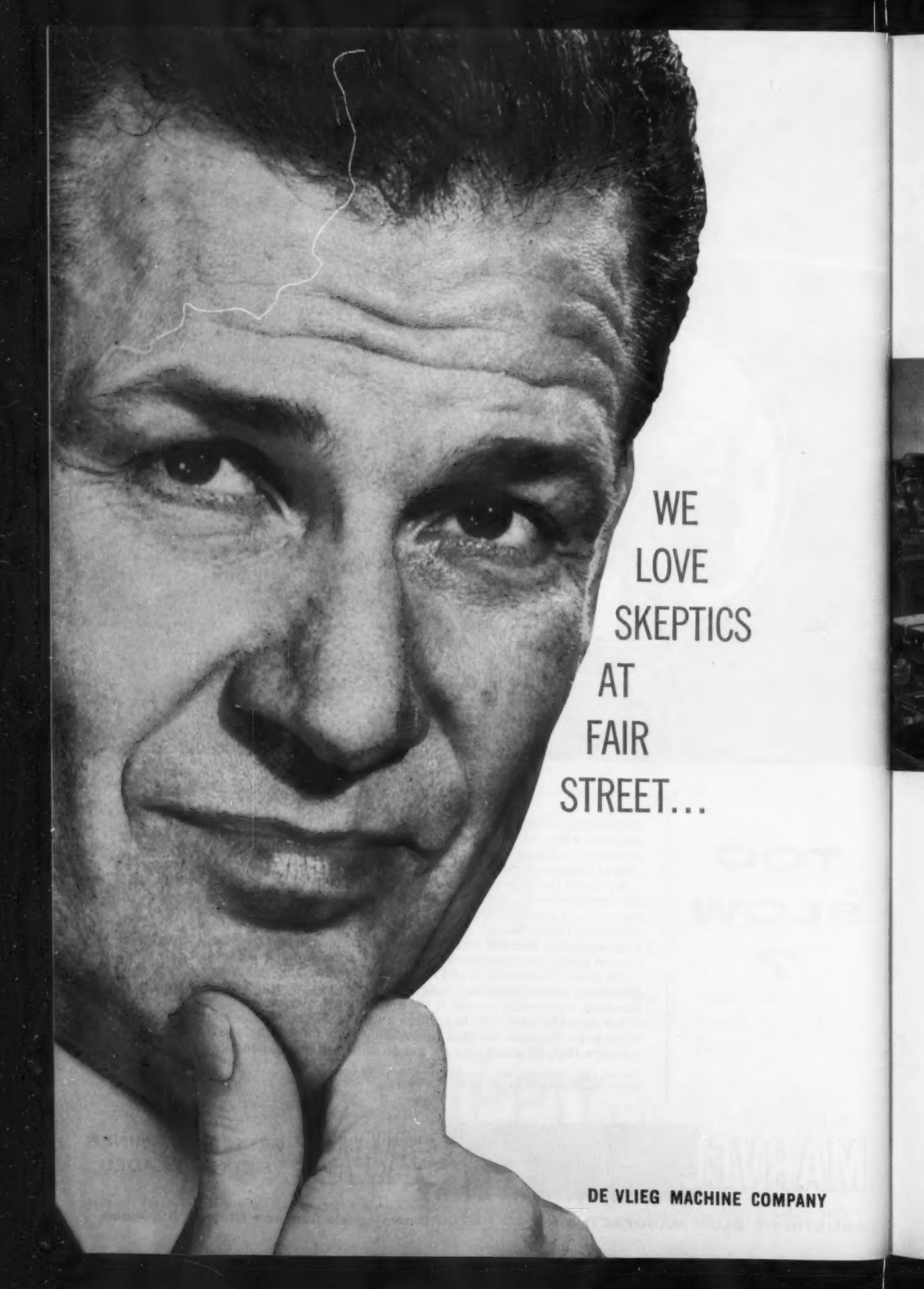
Ask your Marvel Dealer to arrange a sawing demonstration—on your own work—if you wish. Because we have consistently built both Hack Saws and Band Saws for more than 40 years, you will get an unbiased recommendation.

Catalog C60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL Metal Cutting SAWs

BETTER MACHINES
BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois



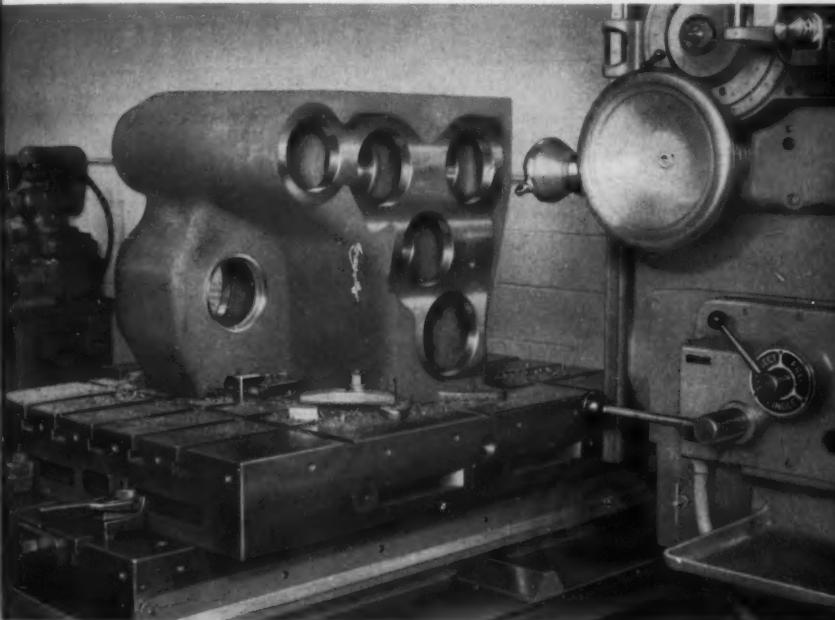
WE
LOVE
SKEPTICS
AT
FAIR
STREET...

DE VLIEG MACHINE COMPANY

Of course, everyone who comes to Fair Street for the first time is a skeptic. At least partially so. But we especially like a good healthy skeptic; the man who finds it hard to swallow all he's heard about the proficiency of our JIGMIL and the soundness of the DeVlieg Philosophy of Precision Machining.

SOME OF OUR JIGMIL USERS

AFC Industries, Inc.
Air Reduction Co., Inc.
Alliance Tool & Machine Co.
Amco Incorporated
Bendix Corp.
Besly Welles Corp.
Bethlehem Steel Co.
Burg Tool Mfg. Co.
Buhr Machine Tool Co.
Cessna Aircraft Co.
Cross Company
Farrel-Birmingham Co., Inc.
Gardner-Denver Co.
Gardner Machine Company
Goulds Pumps, Inc.
Harnischfeger Corp.
Hill Machinery Co.
Homogenette Inc.
Hoover Tool & Die Co.



DeVlieg Spiramatic JIGMIL precision bores and mills mining machine transmission housing from two sides on a 180° index.

The JIGMIL is one of those things that you've got to see demonstrated to believe. Only by seeing it demonstrated will you know its complete range of capabilities. The accuracies that it routinely achieves. The ease with which it operates. How simple it is to program or control. How easy to maintain. How rugged and durable it is. If you're a good healthy skeptic, why not visit Fair Street! As we've just said, we'd love to have you. After all, some of our biggest skeptics have become our best customers.

WILL YOU BE THE NEXT TO VISIT FAIR STREET?

FAIR STREET • ROYAL OAK, MICHIGAN



Basic Principles in the DeVlieg Philosophy of Precision Machining

- A Machine Tool Capable of Desired Accuracies
- Correct Tool Geometry
- A Method of Tool Preparation and Maintenance

Only DeVlieg Delivers the Complete Package!

Hyster Co.
Ideal Tool & Mfg. Co.
Lake Erie Machinery Corp.
Leesona Corp.
Marion Power Shovel Co.
Mason, Shaver & Rhoades Inc.
Midwest Machine & Mfg. Co.
National Electrical Welding Machines Co.
National Mine Service Co.
New Deal Tool & Machine Co.
Paramount Boring & Machine Co.
Paul Machine Tool & Die Works
Quality Tool and Die Co.
R & B Tool Company
Rochester Products Div., GMC
Saginaw Steering Gear Div., GMC
Snyder Corp.
Standard Tool Co.
Vard Div., Royal Industries Inc.
Vogt, Henry Machine Co.

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES
IN PRECISE LOCATIONS



Verson - TRANSMAT IMPACT MACHINING gives you better piece parts at lower cost

A TYPICAL PART



Slug—

Diameter .1.650"
Thickness .0.820"

Extruded Part—

Across hex flats .1.86"
I.D. 1.268"
Flange thickness .0.190"
Height 1.58"

The Transmat Impact Machining press illustrated above produces four types of automotive ball joint housings. Three operations are performed: 1. Backward extrude; 2. Pierce bottom; 3. Coin flange and form bottom. The press operates at 26 strokes per minute, delivering one socket on each stroke.

Originators and pioneers of allsteel stamping press construction

VERSON ALLSTEEL PRESS CO.

Many parts that previously had to be produced by metal removal processes or hot forged can now be produced better, faster, and more economically by Impact Machining. Impact Machining is the practical application of the principles of cold extrusion to steel and non-ferrous metals. Combined with Verson Transmat equipment, Impact Machining offers remarkable opportunities for the efficient, economical production of large quantities of parts requiring multiple operations.

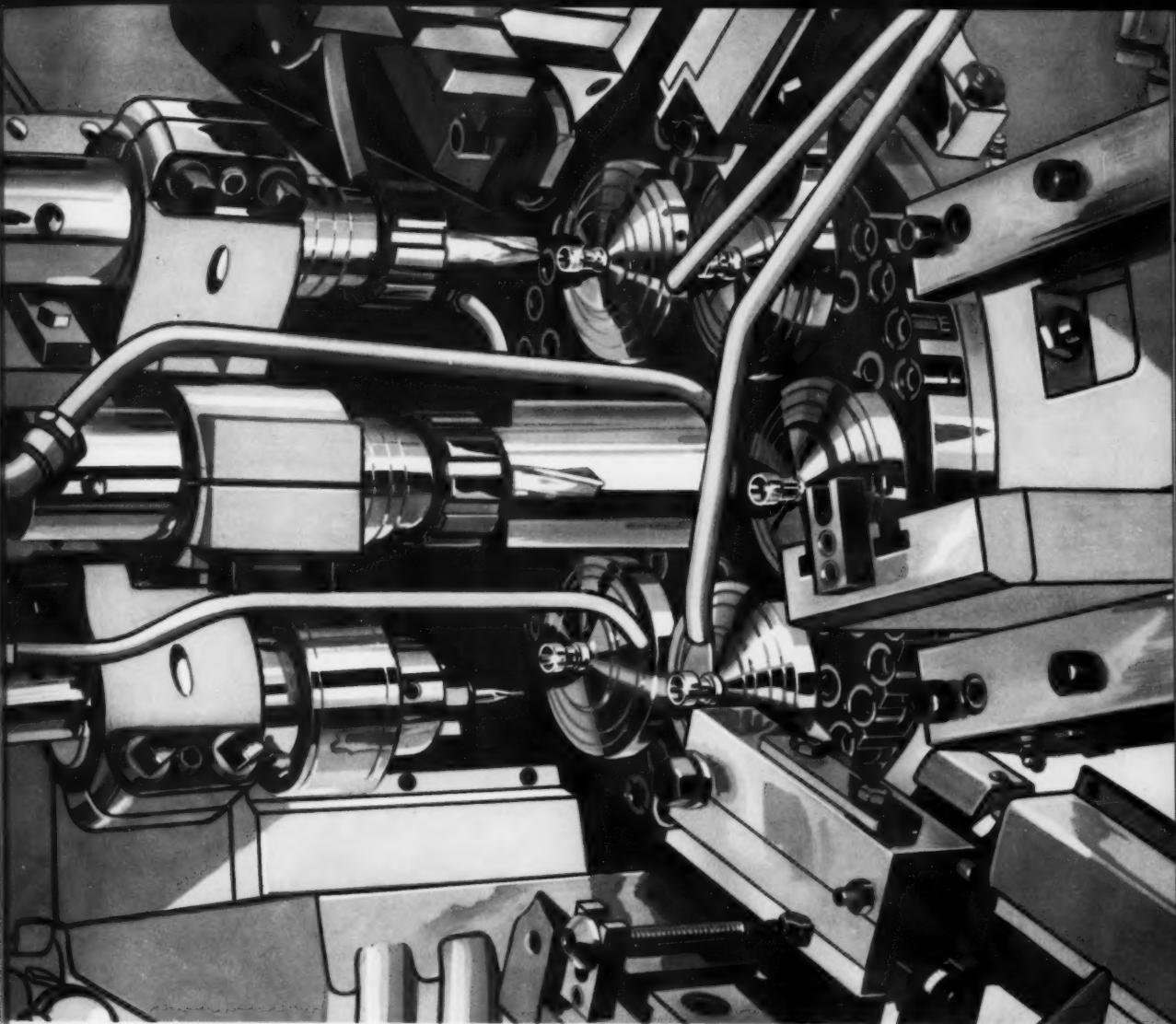
If you produce machined parts in quantity, ask for an appraisal of the suitability of Transmat Impact Machining for your needs. Just send an outline of your requirements.

208



9309 S. Kenwood Avenue, Chicago 19, Illinois • 8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • IMPACT MACHINING PRESSES
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES • PLASTICS MOLDING PRESSES • HYDRAULIC SHEARS

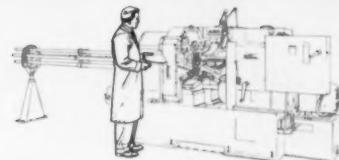


The newest bar machines are New Britains

How much work can you wring out of a bar machine? It depends on the machine, how it's tooled and who's using it. New Britain's New-Series Bar Machines are setting some pretty enviable productivity records right now. These machines, redesigned from the ground up, are the most advanced units of their kind available to the metalworking industry.

The four-spindle machines have capacity up to $5\frac{1}{8}$ " and all the massiveness and power needed to turn work of this size.

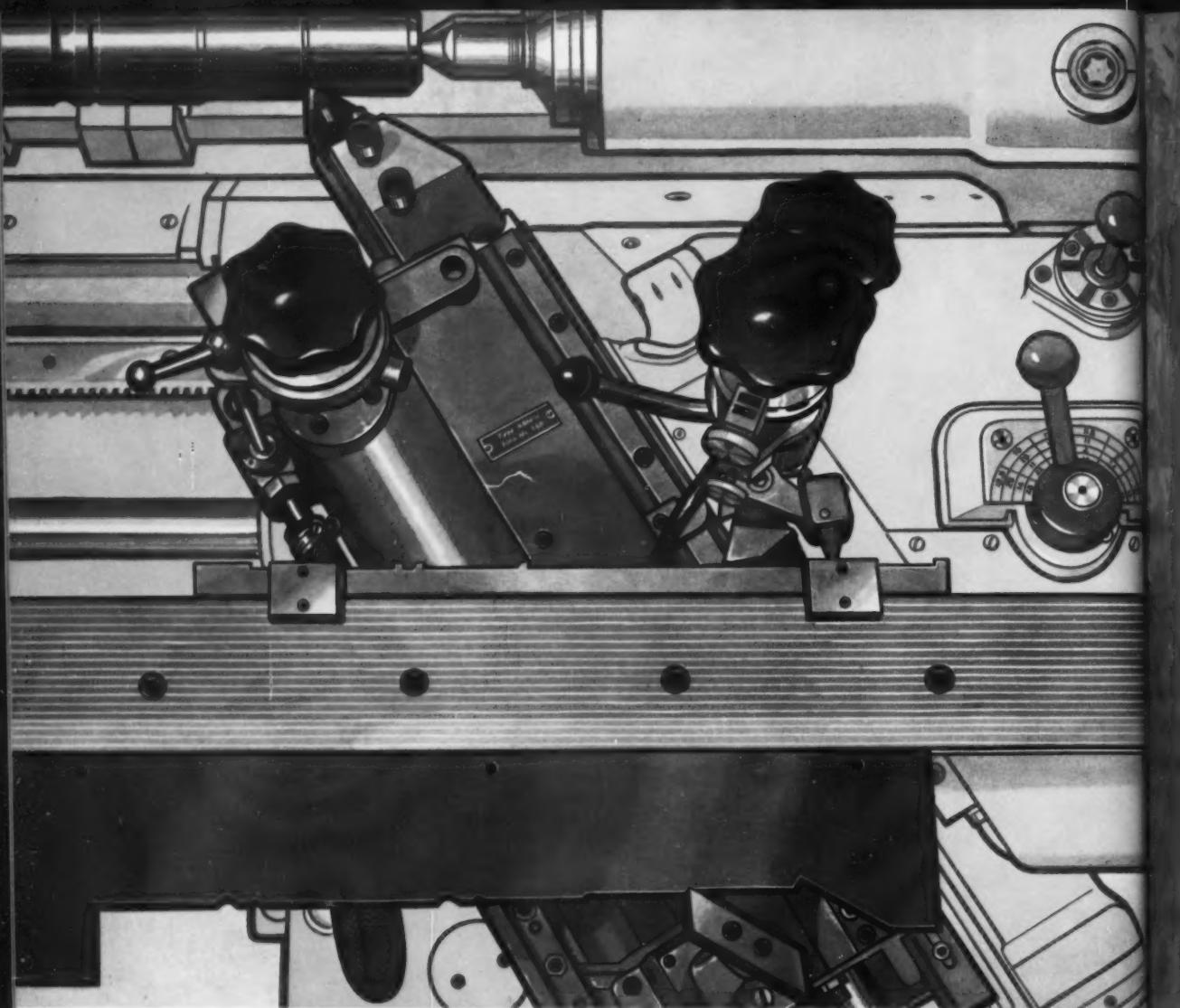
New series six-spindle machines in various models have capacities ranging up to $3\frac{1}{2}$ ". The eight-spindle machines take work to $2\frac{5}{8}$ " capacity.



Increased capacity is only part of the story. Tooling combinations are practically limitless. With end-working and cross slide tooling in every position on every model, the greatest possible variety of operations can be performed to the highest order of accuracy. Numerous familiar New Britain features, like spindle carrier lifting and locating, have been retained and improved. A great many exclusive new features have been added.

Why not send for our new catalogs which give the whole story in detail or call your New Britain representative to arrange a demonstration?

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut



Fast set-up, quick changeover with *New Britain +GF+ copying lathes*

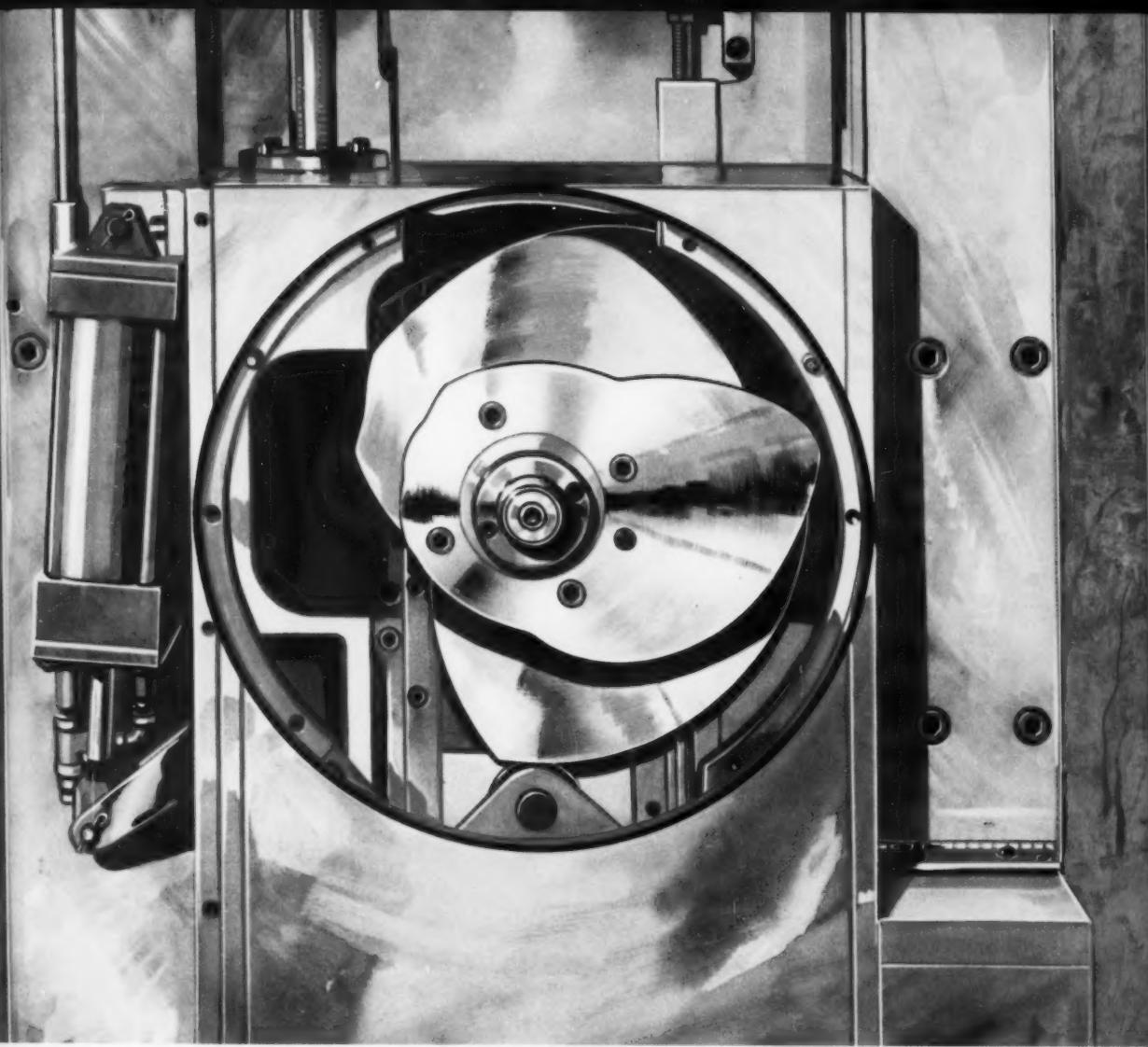
The basic design of a New Britain +GF+ copying lathe can start to save you money on the first job you put on it. Because the single tool is guided by either a prototype or a template, set-up time is reduced to minutes. The single tool can be changed in minutes, too. Every dimension is positively transmitted from template or prototype to the work, making adjustment a simple matter of bringing only one dimension to size. A +GF+ does a great variety of work—shafts, chucking work, internal and external copy turning. Backfacing is accomplished by

a simple attachment. Multi-cut recycling for the removal of heavy stock concentration can also be provided.

The versatility of application is pretty much limited only by the ingenuity of the individual. For more complicated jobs, New Britain can provide the most complete selection of steadies, special tooling attachments and other accessories available for any lathe anywhere. A complete range of models and sizes is available. Why not write for our new +GF+ copying lathe catalog?



THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut



Exclusive New Britain design for greater boring accuracy

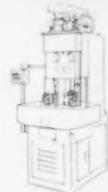
This is the vertical slide of one of the new series New Britain Vertical Contour Turning and Boring Machines with the front plate removed exposing the cams. These cams are mounted on a common shaft which rides with the vertical slide controlling its motion as well as the motion of the cross slide. Containing all slide actuating forces in the vertical slide is an exclusive New Britain feature which represents a major development in boring machine design.

No outside forces are imposed on the slide ways. Extreme accuracy and rigidity are achieved per-

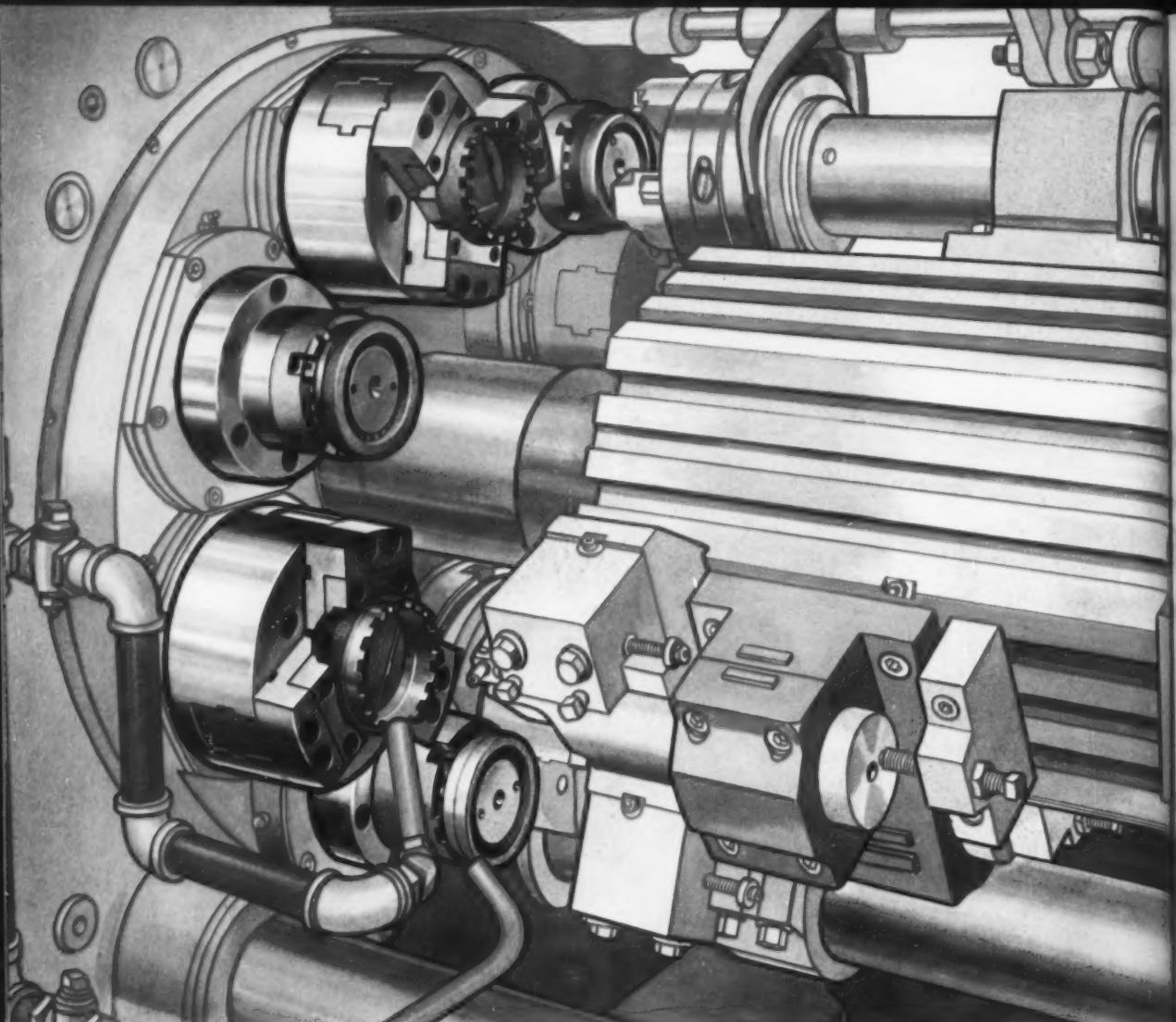
mitting heavy cuts. Finish cuts of less than .0003 tolerance can be made on the same set-up.

The elimination of long actuating linkages has allowed for the design of a compact, clean sided, simplified machine. Cams are quickly accessible and easy to change.

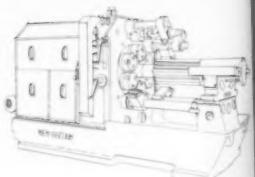
The major improvement which the cam-in-head principle makes on the already widely accepted superiority of cam control results in high repetitive accuracy regardless of the complexity of the piece. Building-block applications, using more than one machine side by side, allow all kinds of possibilities for increased production efficiency.



THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut



Double indexing... differential chucking pressures with *New Britains*



Here are two features that go a long way toward indicating how much and what kind of work you can do on New Britain's Chuckers. The double indexing feature is a really workable approach to the production of two identical pieces per cycle or both sides of a piece. This application can frequently eliminate the need for second-operation machines. Chucking pressures can be adjusted so that as the machine progresses through the cycle, and more and more metal is removed, the piece will not be distorted.

These are only two of a dozen different New

Britain Chucking Machine features. These rugged, powerful machines are your best bet for high production turning, forming, facing, threading, tapping and related operations. New Britain's complete line of chuckers includes four-, six- and eight-spindle models, with work swing up to 17 inches. Wide open design in all models allows for the quickest possible disposition of chips.

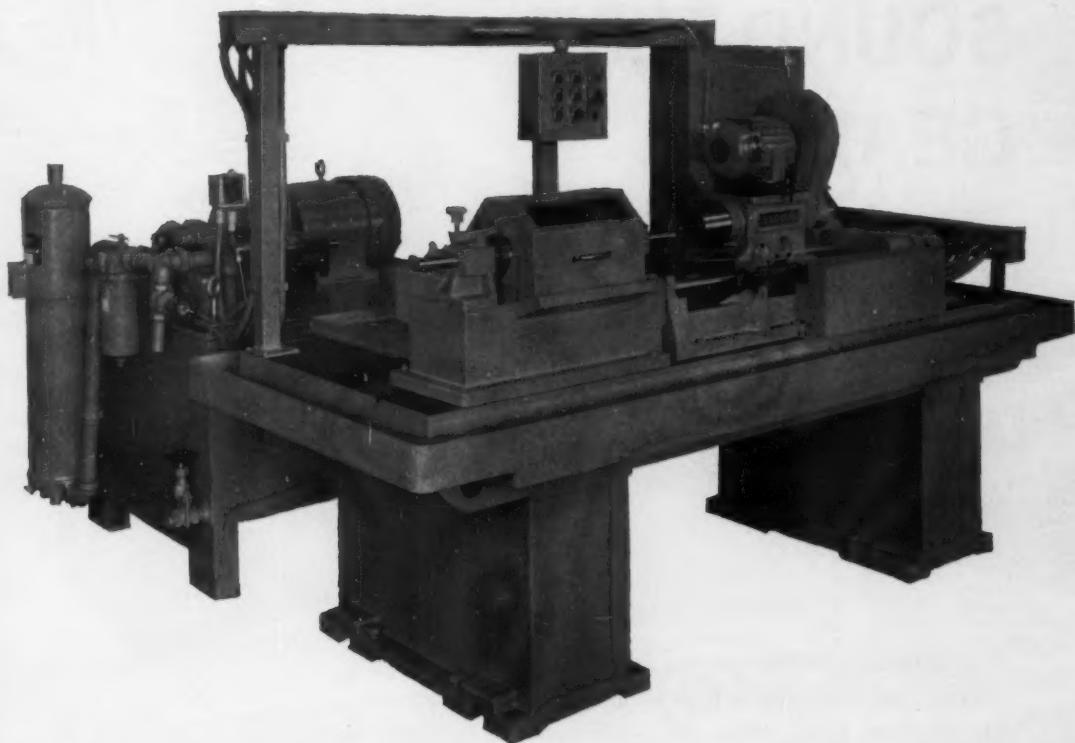
Make a point of calling in your New Britain representative soon. Let him show you the dollars and cents reasons for including New Britains in your replacement or expansion plans.

THE NEW BRITAIN MACHINE COMPANY
New Britain-Gridley Machine Division • New Britain, Connecticut

NEW LELAND-GIFFORD HORIZONTAL GUN DRILL

WITH

- Lead screw or hydraulic feed drilling unit
- Base to suit requirements
- High pressure coolant system



Designed to deliver both performance and production, this new Leland-Gifford Horizontal Gun Drill is completely adaptable to your deep hole drilling needs.

Available with hydraulic or lead screw feed to suit your range of hole depths up to $\frac{3}{4}$ " diameter. Can be furnished with traverse up to 48 inches.

An ideal machine for your job can be developed . . . on a standard or custom base, with or without tooling, with or without high pressure coolant systems.

Leland-Gifford's long-established reputation, broad range of experience and complete line of drilling machines is your assurance of the most successful solutions to your drilling problems.

*Write for complete information — or ask
to have an experienced sales engineer call.*



LELAND - GIFFORD
WORCESTER 1, MASSACHUSETTS
DRILLING MACHINES



HUMAN EAR No longer needed to SOUND-TEST GEARS



The inspector's hearing and his judgement have not always been dependable in discriminating between gear noise which may be tolerated and that which may not. In fact, these human qualities are not consistent even in the same individual at all times.

To avoid such inconsistencies, the Red Ring Sound Tester may now be equipped with an electronic broad-band amplifier. Sound intensity is measured and the result indicated on a graduated visual scale. Thus, it is simple to establish sound tolerance limits independent of the human equation and maintain uniform quality.



SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTOID

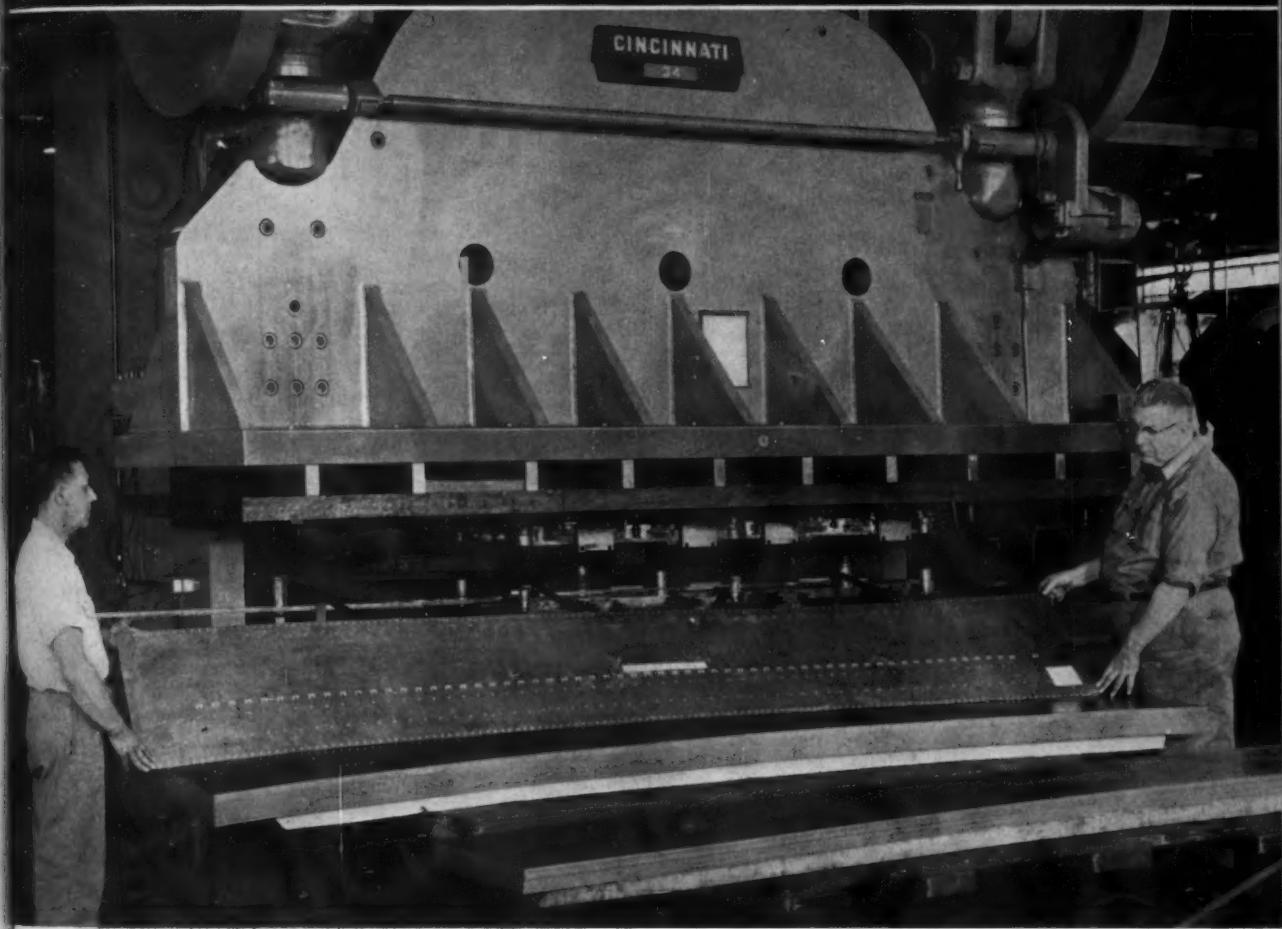
For further information write for Bulletin C 60-8

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING AND HONING EQUIPMENT

CINCINNATI® PRESS BRAKE cuts press work costs



Courtesy Dahlstrom Manufacturing Corporation, Jamestown, N. Y.

For half the initial cost of a conventional press with equal die area and tonnage, the Dahlstrom Manufacturing Corporation does its press work on a Cincinnati Press Brake with widened bed and ram.

Its low first cost has been followed by other savings, too. For example, setup and operation are easy and fast because the die area is out in front of the housings. Floor-to-floor time per piece is half what it was with previous production methods. Cincinnati accuracy holds .005" tolerances between holes.

Dahlstrom uses the full versatility of the Cincinnati Press Brake for shallow draw work, blanking, notching, and punching. Ask our representative to show you how to earn similar savings in your shop.

Shapers / Shears / Press Brakes

THE CINCINNATI



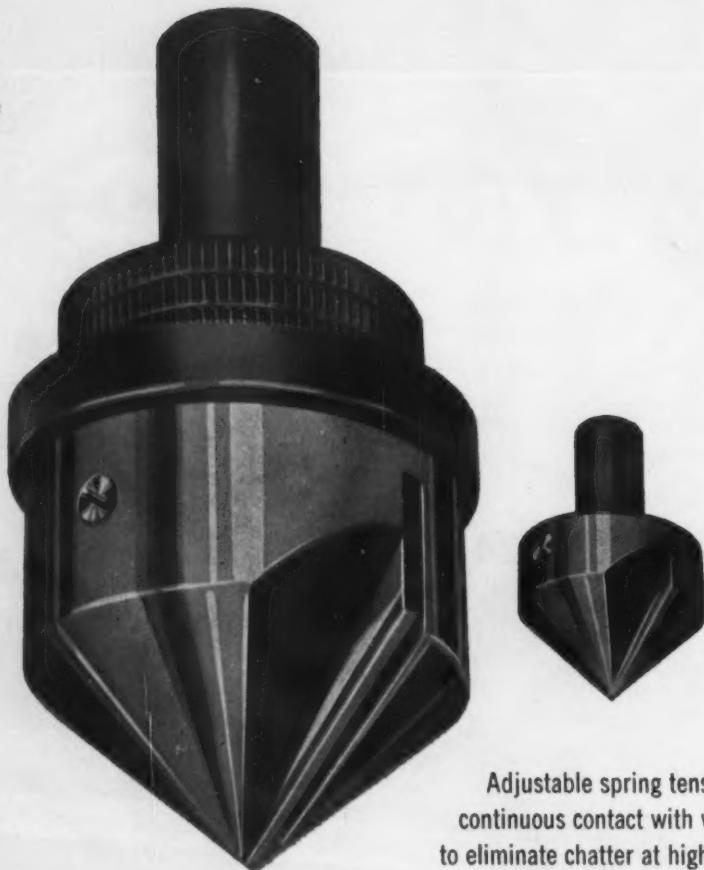
SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

United Kingdom: The Cincinnati Shaper Co., Ltd., Glasgow, Scotland



UNIVERSAL R & R
DEBURRING TOOLS
with spring-loaded
retractable blade
give precision-cut edge
or chamfer at high
speed without
chatter



Adjustable spring tension allows continuous contact with work-piece to eliminate chatter at high operating speeds. Free-floating blade permits self-alignment and uniform stock removal. Made in a full range of sizes to 1½" diameter.

Blades of the Universal R & R Deburring Tool are made of high speed steel, precision hardened and ground to close tolerances for interchangeability. May be used as horizontal deburrer in portable electric drill or in standard drill press.

For full information, write to Universal Engineering Company.



Write today for complete catalog of
Universal Engineering products.

UNIVERSAL ENGINEERING COMPANY • FRANKENMUTH 2, MICHIGAN

Keeping up with Washington

- ★ Two-Pronged Approach
- ★ Import-Export Outlook
- ★ Vacuum Specialists Convene

MACHINERY PEOPLE in Washington see as a straw in the wind the President's announcement that the Treasury Department has halved its estimate of the useful life of textile machinery. This speed-up of depreciation schedules for a single industry is being taken as an indication that similar action may be anticipated in other fields. Action of the Internal Revenue Service is in response to the Presidential directive of May 2, calling for an early review of depreciation allowances in the textile industry. Decisions concerning other industries, the White House announcement observed, will depend upon their particular conditions and circumstances.

Two-Pronged Approach

Although revealing that broad tax revisions cannot be looked for before 1963, Treasury Under Secretary Henry H. Fowler has spoken confidently of a two-pronged approach. Depreciation speed-up is one; another is the income-tax credit. The latter plan proposes an 8 per cent across-the-board tax credit for investment in tangible personal property having a useful life of six years or more.

The President's announcement of a depreciation speed-up for the textile industry, coupled with information that other industries are being surveyed, removes a strong objection to the tax credit plan. Opposing forces had felt that adopting the income-tax credit plan might retard revision of depreciation schedules.

The Treasury Under Secretary indicated that both approaches are being pushed because of a realization that increasing investment in productive machinery and equipment contributes significantly to three national objectives. It encourages the long-term growth of the economy, improves our international balance of payments position by increasing competitive efficiency, and contributes toward making our present economic recovery a vigorous and long-lasting one.

"Adjustments in depreciation rates because of changes in the permissible lives of assets," Under Secretary Fowler commented, "should not be confused with the investment tax credit or other measures designed primarily to provide incentives for modernization and expansion of capital equipment. However, where they become applicable, liberalized depreciation allowances will incidentally facilitate and encourage modernization and expansion of investment in machinery and equipment and other capital facilities."

Under Secretary Fowler indicated that the results of depreciation studies would be submitted to appropriate committees of Congress during the next session as a basis for legislative proposals for tax revision and reform.

Import-Export Outlook

Recent visit of the Finnish president and entourage revealed the possibility of a \$100,000,000 market for American machine tools in Finland in the next five years. The promising news came from Ake Kihlman, a member of the Finnish Trade Development Mission. Finland, he says, looks to the United States for patents, licenses, tools, and machines to help the country to industrialize more fully. He also indicated that while American equipment tends to be more expensive than machinery from Britain, West Germany, and Russia, there is still a demand for American machine tools of advanced design.

Other analysts predict a cutback in our exports to Europe—particularly for machinery and similar capital goods—when Britain joins the European Common Market. If the Scandinavian countries also join the market setup, a further decline of United States exports seems likely.

Despite such prospects, United States officials favor strengthening of the European Common Market as a means of enabling Western Europe to withstand military and economic pressures from the Soviet countries. In view of this possibility, American exporters of capital goods and industrial raw materials are being advised to "mend their fences" in Latin American countries.

Vacuum Specialists Convene

Visitors to the recent Second International Congress on Vacuum Technology, held in Washington, D. C., found much food for thought in technical displays and scientific papers. Until recently of secondary importance, the production of ultra-high vacuum equipment for commercial, military, and industrial purposes is becoming a rapidly growing industry. In addition to simulating conditions to be encountered by man and metals in outer space, vacuum technology is solving the problems of shaping, cutting, and annealing exotic metals and alloys, providing the answer to working with metals and materials which have defied conventional procedures.

Numerous American firms were represented at the congress, with a generous sprinkling from West Germany, Britain, and Scandinavian countries. Equipment was displayed for melting, purifying, and refining metals; for producing thin-film, molelectronic devices; and for welding and cutting metals.

Evident from the displays and the papers presented was the likelihood that as long as missile and space-probe programs continue, many producers of machinery and allied equipment will find it profitable to take a second look at the field of "no-air" equipment.

HARDINGE
ELMIRA, N.Y.

SUPER-PRECISION

**HIGH SPEED TOOL ROOM
LATHE**



Model HLV-H

*This Is Our New Model Designed And Manufactured To
Meet Exacting Requirements For Close Tolerances And
Fine Finish.*



Realistic Depreciation Appears Imminent

STRAWS IN THE WIND indicate that the Washington Administration is about to give industry a better "break" on depreciation allowances for new capital equipment. This has been forecast by the special consideration given the textile industry by the Treasury Department and statements made by prominent officials of that department.

For years business leaders have been trying to convince Government men of the necessity of allowing realistic depreciation of equipment in order to enable industrial plants to be modernized. Their work seems about to bear fruit.

Reasons given by the Administration for this more generous attitude on depreciation are those which have been consistently emphasized by industry men. Faster depreciation of assets and tax savings in the immediate future should result in plant installation of new machinery and tools that would enable our manufacturers to better meet foreign competition. Business activities would also be stimulated for concerns that build manufacturing equipment. Finally, the growth of the entire economy would be vitalized.

Our manufacturing plants in too many instances have fallen far behind in efficiency, as compared with foreign plants rebuilt after the war. The anticipated tax relief should help them to catch up.

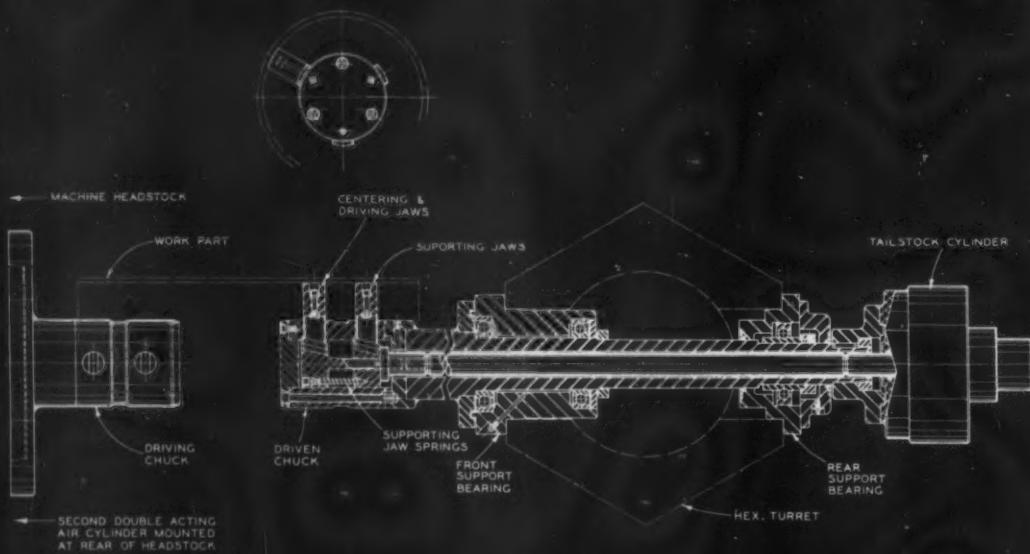
It is estimated that this tax relief will amount to from \$2,000,000,000 to \$3,000,000,000 yearly. This is only a temporary tax loss to the Government because when new equipment has been fully depreciated—at an earlier date than before—increased taxes will even the account. Besides, there should be greater taxes because of higher profits resulting from increased manufacturing efficiency.

Charges have already been made that this new attitude on depreciation of capital goods is an effort on the part of President Kennedy to prove that he is not "antibusiness." It should, therefore, be stressed that more people will have to be employed to produce capital goods. Business and labor will both profit, especially in the machine tool and other machinery-building industries.

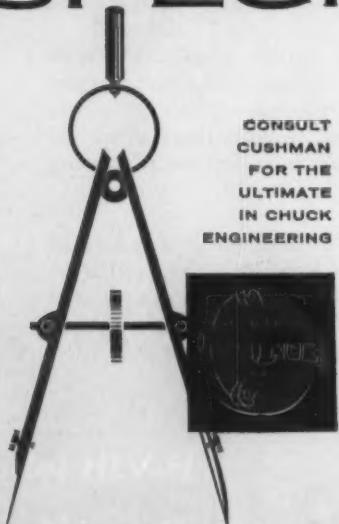
Charles O. Herb

EDITOR

SOLVE YOUR DIFFICULT WORKHOLDING PROBLEMS WITH



SPECIAL CHUCKS



CONSULT
CUSHMAN
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ULTIMATE
IN CHUCK
ENGINEERING

The assembly print reproduced above is but one of many examples of special chucks designed and engineered to meet unusual workholding and machining requirements. Cushman Special Chucks are being used in many diverse industries enabling manufacturers to meet realistic production quotas, maintain close tolerances and achieve lowest cost on both short or long runs.

If you have a workholding problem, consult Cushman. Your problem may have already been solved.

THE CUSHMAN CHUCK COMPANY • HARTFORD 2, CONNECTICUT

Manufacturers of Air and Manually Operated Chucks, Power Wrenches, and Face Plate Jaws.

Buick builds
automotive industry's
first

6

CHARLES H. WICK, Midwestern Editor

A NOTHER BUICK FIRST in outstanding engineering achievements is the introduction of a new 90-degree, cast-iron V-6 engine. The first power plant of this type in the industry, it will be used on all standard 1962 models in the Buick Special Series. Basic engine configuration (heading illustration) closely resembles the 215-cubic-inch aluminum V-8 engine introduced a year ago. However, the cylinder bores have been



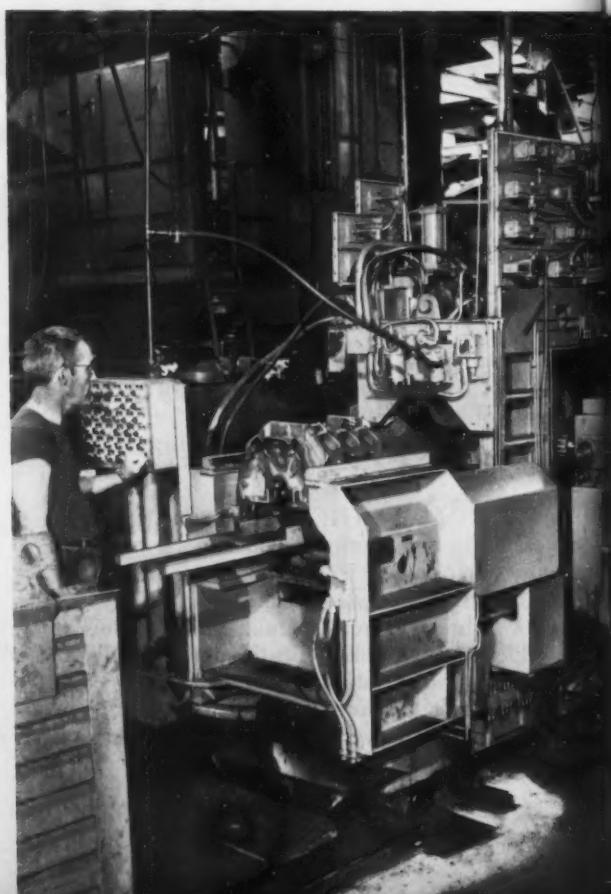
**With a crash tooling program
completed in four months
with the cooperation of many
machine tool manufacturers,
Buick has stolen a march
on the rest of the industry
with a cast-iron V-6 engine.
Here are some of the high-
lights of this newest
power-plant production line**

increased to 3.625 inches and the stroke to 3.200 inches, giving a displacement of 198 cubic inches and 135 hp with six cylinders.

The 90-degree layout makes possible a light, rigid, and compact engine. It is from 140 to 179 pounds lighter than current in-line, six-cylinder engines of comparable power output. The lighter weight permits greater gas economy and less steering effort when parking the car. Rigidity assures a smooth, quiet, and long-life engine. Also, the short crankshaft minimizes roughness and engine vibration.

A remarkable feat in tooling up for the production of the V-6 engines was that the first engines were produced in less than four months from the date of the first equipment orders. Previous engine tooling programs required a minimum of one year. Such a crash tooling program was only accomplished by the close cooperation of many machine tool manufacturers and other suppliers, and the diligent planning and follow-through of Buick engineers. Tool and process engineers were moved into offices right in the engine plant to expedite the program. A total of fourteen new machines and seventy-nine rebuilt and retooled machines were required. Much of the rebuilding was done at Buick, with heads, bases, fixtures, tools, and other components supplied by vendors.

Fig. 1. Side locating lugs, rear locating pad, and top cover rails of the cylinder blocks are milled on this five-station transfer machine.



Initial processing of the cast-iron cylinder blocks for the V-6 engine is done on a new Sundstrand Rigidmil, Fig. 1. The blocks are loaded into the machine at the first station with their pan rails down and front ends leading. At the second station, locating lugs on the sides of the block and a locating pad on the rear face are milled. These operations are performed with a total of five tools—three face type and two plain milling cutters having tungsten-carbide inserted blades.

Station 3 is idle, and at the fourth station the top cover rails of the blocks are milled with two vertical-spindle face-milling cutters. At the fifth station, Fig. 2, the blocks are automatically rotated 180 degrees to dump the chips and unload. Transfer of the blocks between stations requires 4.8 seconds; positioning, clamping, and unclamping takes 6 seconds; rapid approach and return of the cutters, 6 seconds; and machining, 21 seconds. This gives a cycle time of 37.8 seconds, and a production of ninety-six blocks per hour at 100 per cent efficiency.

Pan rail, main bearing, and bank surfaces of the blocks are broached on a Cincinnati two-way broaching machine that was retooled at Buick. The machine is now equipped with square, tungsten-carbide nibbler inserts. A rebuilt Ingersoll

forty-three station transfer machine is then employed to drill and ream two pan-rail locating holes; mill the front and rear surfaces of the bearings, the starter pocket and pads, and front and rear ends of the block; and rough-bore and chamfer the cylinder bores. Various holes—including oil, water, starter, and camshaft—are drilled, reamed, tapped, bored, counterbored, and chamfered on a Barnes twenty-seven-station transfer machine. Also, all holes are probed, all blind holes are blown out, and the oil-gallery holes, which are drilled in eleven successive steps, are leak-tested. Barnes furnished new spindle heads and rebuilt the fixtures for this existing machine.

A Footburtt nineteen-station transfer machine was reworked to drill, ream, chamfer, and probe additional holes in the blocks, and mill the bearing lock slots. Two reworked Greenlee transfer machines—one having eighteen stations and the other, twenty stations—are used to drill, ream, chamfer, countersink, tap, blow out, and probe a total of fifty-nine holes in each block. Then the blocks are washed and the bearing caps assembled with a multiple-spindle nutrunner.

Rear main bearings are counterbored, and the oil-seal and deflector grooves are formed on a Natco sixteen-station double-index transfer machine that has been equipped with reworked

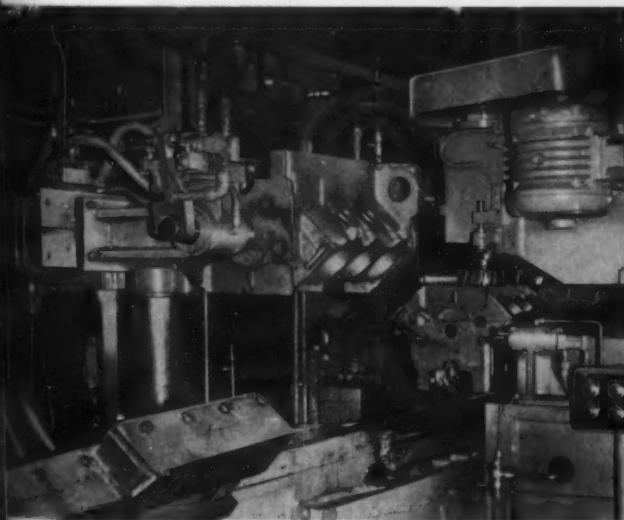


Fig. 2. At the unloading end of the milling machine (Fig. 1), the blocks are rotated through 180 degrees to dump the chips.

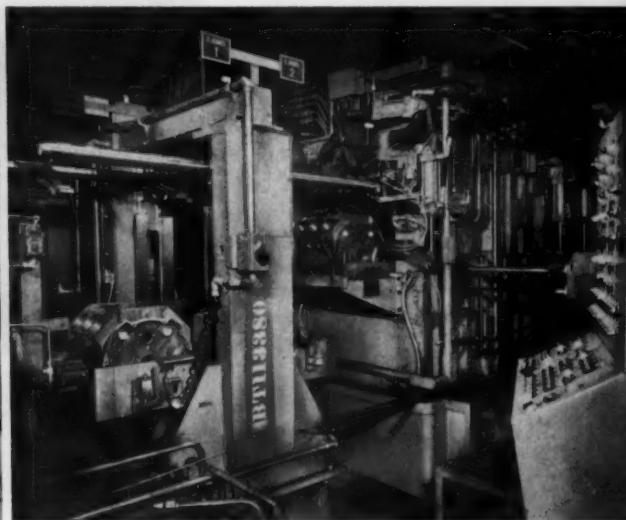


Fig. 3. Loading end of eleven-station transfer machine where cam bearings are core-drilled and bored, and center bearing is faced.

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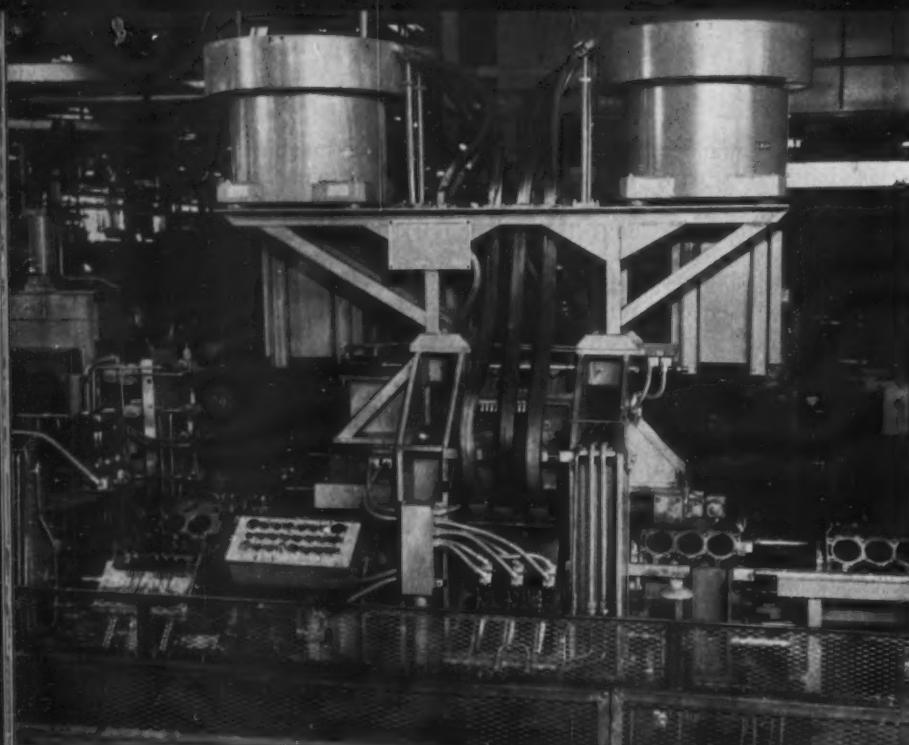


Fig. 4. (Above) Six cup plugs, fed from the two hoppers above, are pressed into each block on this assembly machine. Sealer was sprayed on the openings at a previous station.

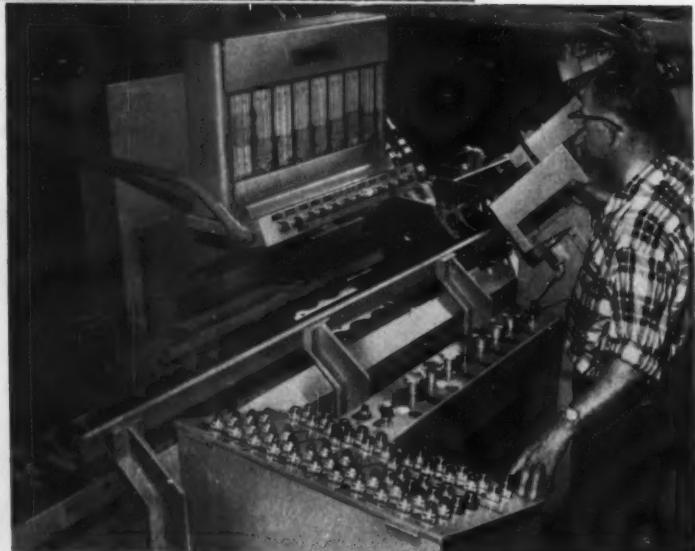


Fig. 5. (Right) Automatic inspection and classifying machine checks bore sizes and stamps them for selective assembly with pistons.

fixtures and heads. A new Lamb eleven-station transfer machine, Fig. 3, is the next unit in the V-6 block processing line. At the first and second stations, two blocks are loaded at a time, and they are elevated to the required transfer height. Station 3 is idle. A left-hand head straddling Stations 4 and 5 is toolled to rough-face and chamfer the thrust faces of the center bearings. These tools are rotated at 224 rpm (200 sfpm for facing) and fed at the rate of 0.0074 ipr (1.66 ipm) to remove about 0.030 inch of stock. The right-hand head at the same stations is used to core-drill the Nos. 3 and 4 cam bearings. Two cutters

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Fig. 7. (Above) Crankshaft lathe is automatically loaded from racks at left. Machined shafts are unloaded and transferred to racks at right.

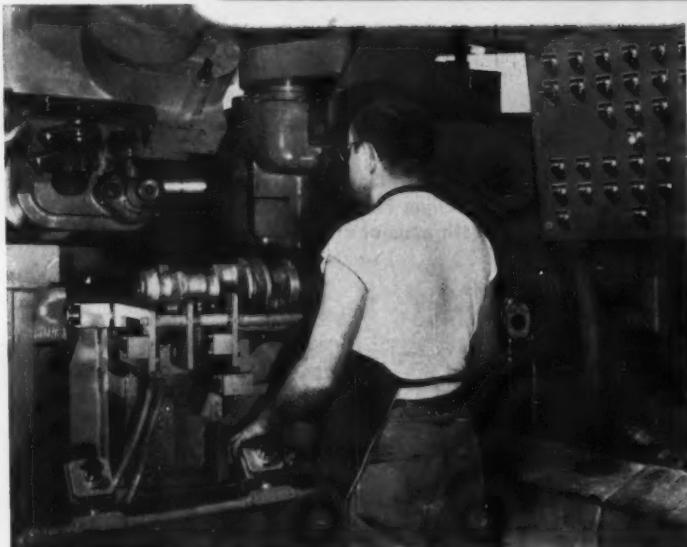


Fig. 6. (Left) A total of eight locating and driving notches are cut in each V-6 engine crankshaft on this milling machine. Cutters are at upper left.

having four tungsten-carbide-tipped inserted blades—rotating at 314 rpm (150 sfpm) and feeding at 0.024 ipr (7.5 ipm)—are employed for this operation.

Station 6 on the Lamb machine is idle. Nos. 1 and 2 cam bearings are bored by tools on the left-hand head at Stations 7 and 8. The right-hand head at these stations is tooled to finish-face the thrust faces of the center bearings, and form the oil-seal and deflector grooves in the rear main bearings. Cycle time, including rapid advance and return of the heads and feeding of the tools, is 37.5 seconds. Being a double-index machine,

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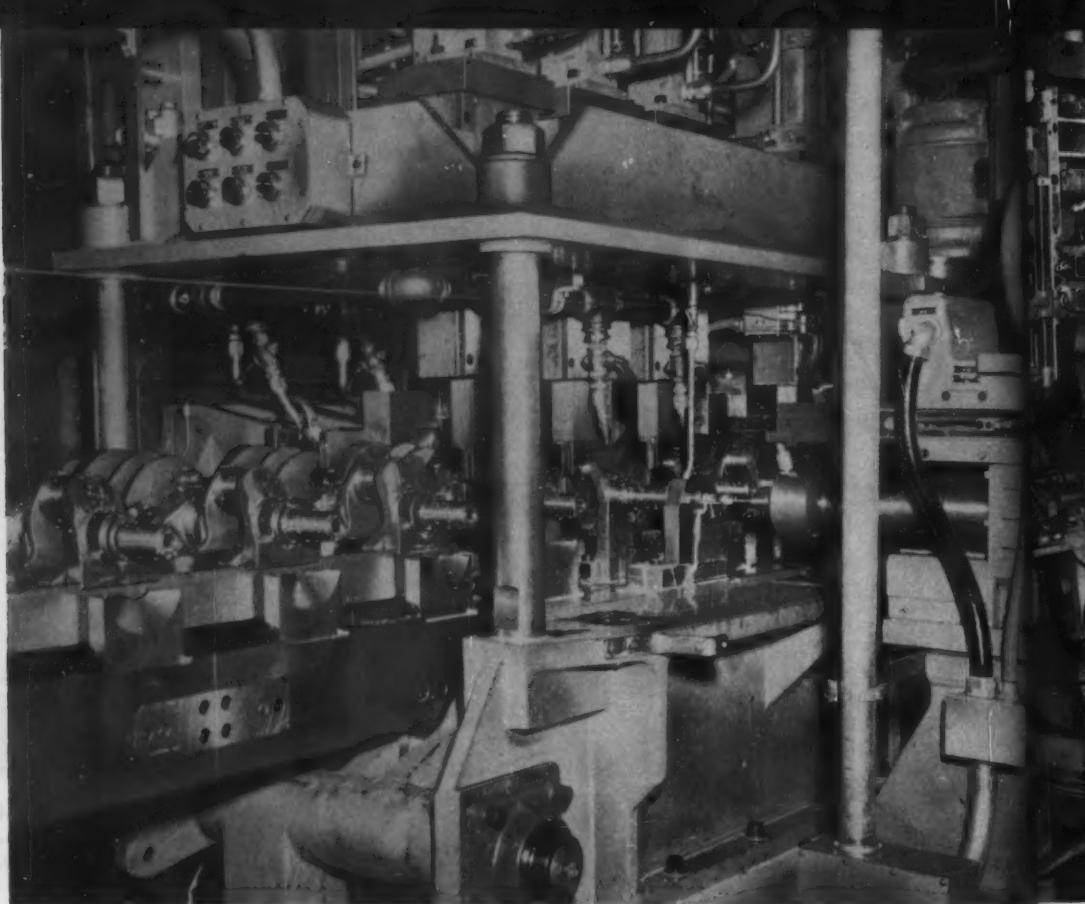
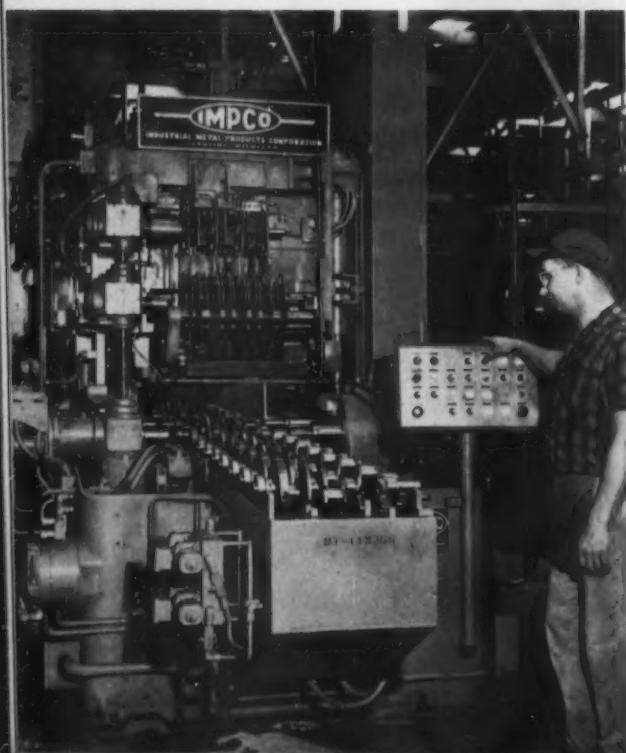


Fig. 8. Unloading end of a thirty-three station transfer machine that is used to perform various operations on both ends of crankshafts.

Fig. 9. Polishing machine for finishing the bearing surfaces and thrust-wall faces of the crankshafts for V-6 engines.



this results in a production rate of 192 blocks per hour at 100 per cent efficiency. Station 9 is idle, and the blocks are unloaded at the tenth and eleventh stations. Crank and cam bores are both semifinish- and finish-bored on a reworked Barnes nine-station transfer machine.

Cam bearings are automatically pressed into the blocks and Welch plugs assembled on two new seven-station transfer machines made by the Detroit Broach & Machine Co. On the cam-bearing assembly machine the blocks are loaded with their pan faces down and rear ends to the right. The oil gallery is brushed out at the second station, and both the cam line and oil gallery are blown out with blasts of air at Station 3. Stations 4 and 6 are idle, and at the fifth station, four cam bearings are pressed into each block. The blocks are unloaded at the seventh station.

On the Welch-plug assembly machine, Fig. 4, the blocks are loaded at the first station, and Stations 2, 4, and 6 are idle. Sealer is sprayed on the openings at the third station, and six hopper-fed cup plugs are pressed into each block at the fifth

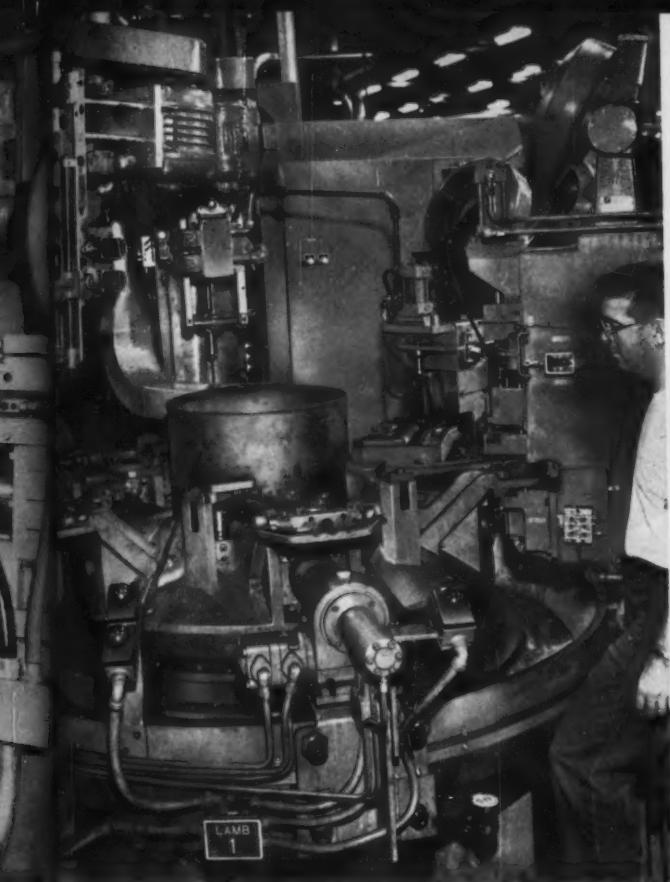


Fig. 10. Drilling, reaming, and pressing of bushings and pins into exhaust manifolds are performed on this six-station dial machine.

station. The two hoppers, each supplying three plugs to each block, can be seen at the top. Blocks are unloaded from the machine at the seventh station.

Semifinish and finish-milling of the bank faces on the blocks is accomplished on a rebuilt Ingersoll six-station transfer machine. Another re-worked Ingersoll machine, this one having three stations, is used to semifinish the cylinder bores. Camshaft and crankshaft bearing surfaces are finish-bored, and four holes are reamed, on a rebuilt Ex-Cell-O ten-station transfer machine. A new Sundstrand four-station machine is employed to mill both ends of each block to an overall length of 16.060 inches (compared to a length of 20.360 inches for the V-8 block). Two Ex-Cell-O and two Barnes three-station transfer machines were reworked to finish-bore and both rough- and finish-hone the cylinder bores. A new four-station machine made by Wilson Engineering is used to mill the locating lugs from the sides of the blocks.

After washing the completely machined engine blocks, they are automatically leak-tested in a rebuilt Centri-Spray unit, then inspected and classified according to cylinder-bore sizes on the Shefield air gaging machine seen in Fig. 5. Diameters, out-of-roundness, the taper, and bellmouth condition of all six bores are checked simultaneously. The bores are grouped into one of ten diameter classifications, each varying from the next in increments of only 0.0003 inch. A memory circuit is used to automatically stamp the classification identifying letter on each bore flange at the next station. This information is teletyped to the piston production department, and used for selective assembly of the pistons.

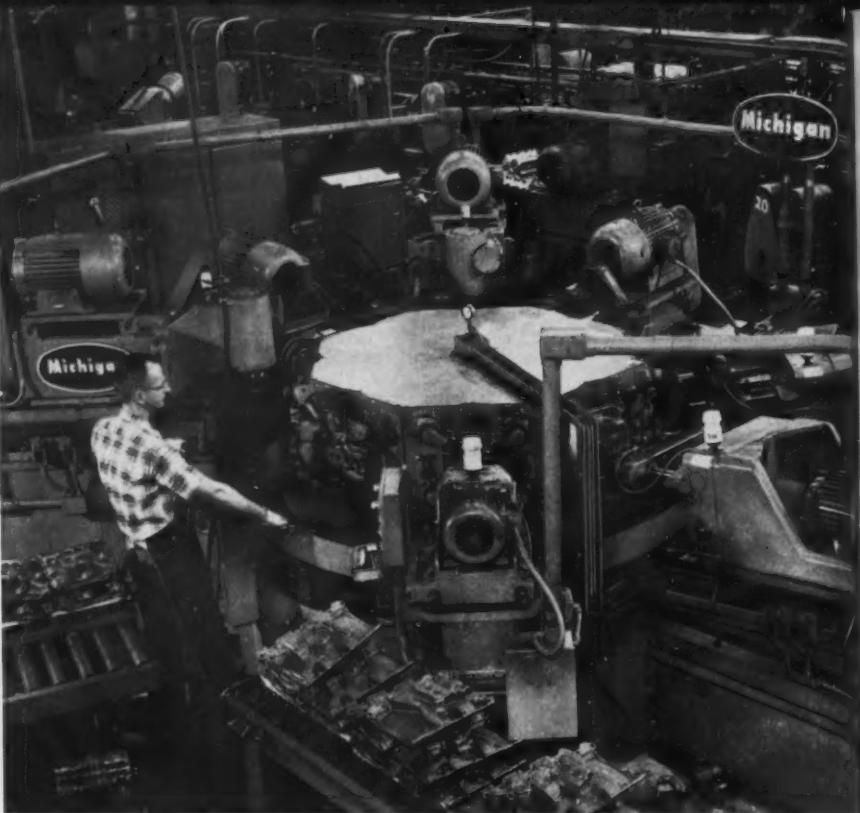
Processing of the crankshafts for the V-6 engines starts on the Producto milling machine shown in Fig. 6. Here a total of eight locating and driving notches are cut in each shaft with four milling cutters, seen at the upper left. The machine is equipped with two right-hand and one left-hand shell end mills, each having twelve tungsten-carbide-tipped blades, and one plain end mill having eight carbide blades.

Wickes crankshaft lathes, such as the one seen in Fig. 7, were rebuilt and equipped with automatic loading and unloading units for facing and turning the five main bearing diameters, flange, and sprocket end of each shaft. Crankshafts to be machined are automatically lifted from the racks seen at the left, traversed to the right, and lowered between headstock and tailstock centers into



Fig. 11. Five-station rotary machine used to rough- and finish-mill both joint faces, and drill various holes in cast-iron intake manifolds.

Fig. 12. Water-outlet pads and carburetor mounting pads are rough- and finish-milled, and holes are drilled and tapped, on this machine.



a power locking center-drive chuck. Clamping of the shaft and the machining cycle are completely automatic.

Each crankshaft lathe is provided with a total of twenty-seven tungsten-carbide inserts mounted in Wesson on-end, band type holders. Triangular, square, and special-form inserts are used to machine the various surfaces. The shafts are rotated at 165 rpm, and the different tools fed at rates from 0.007 to 0.020 ipr. Cycle time is 0.665 minute, resulting in a production of ninety shafts per hour at 100 per cent efficiency. Machined shafts are automatically unclamped, lifted from the lathe, traversed to the right, and lowered onto the racks seen at the lower right.

A new Ex-Cell-O thirty-three station transfer machine has been installed to drill, counterbore, and tap all holes in both ends of the crankshafts; turn the oil-seal and pilot diameter faces, and undercut the pilot; mill a keyway; and recenter both ends of the shafts. The unloading end of this machine is shown in Fig. 8.

All of the bearing surfaces and the thrust-wall faces are polished, and the oil-seal surface on each crankshaft is knurled on an Impco four-station microfinishing machine, Fig. 9. Shafts are placed on a walking-beam type transfer unit, which carries them into the machine. Emery cloth of 240 grain size and polishing shoes are used to polish the bearing surfaces to a finish of 15 micro-

inches, and maintain tolerances on the diameters of plus or minus 0.0005 inch.

A new Lamb six-station dial type machine, Fig. 10, is used in processing the right-hand exhaust manifolds. The castings are automatically clamped in the work-holding fixture at the first station, seen in the foreground, by means of a power clamping and unclamping mechanism. At the second station (left), a hole 0.2913 inch in diameter is drilled through each casting. Two holes, 0.183 inch in diameter, are drilled to a depth of 0.400 inch at Station 3. When the manifold has been indexed to the fourth station (rear), the through hole is reamed to a diameter of 0.315 inch. Two bushings, which serve as bearings for pivoting the exhaust weight and butterfly valve of the manifold, are pressed into each casting at Station 5. The bushings are supplied from rotary hoppers (upper right) and pressed into place with hydraulically actuated, single-ram pressing mechanisms. At the sixth station, two pins, which serve as spring stops, are pressed into each manifold.

A five-station rotary milling and drilling machine, Fig. 11, made by the Special Machine Tool Co., is one of two new machines installed at Buick to produce the intake manifolds for V-8 engines. Loading and unloading is performed at the first station, with the castings being clamped in a vertical position. At Station 2, both joint faces on

each manifold are rough-milled with a dual-angle milling head having two 6-inch diameter cutters. Seven mounting holes, 0.500 inch in diameter, are drilled, and two locating holes are both drilled and reamed with subland tools at the third station. At Station 4, four more holes are drilled in each casting, and both joint faces are finish-milled at the fifth station. Rough milling is done at 254 sfpm (194 rpm) and finish milling, at 304 sfpm (232 rpm). Both rough- and finish-milling cutters are fed at the rate of 48 ipm. The tools are rapidly advanced and returned at the rate of 240 ipm, resulting in a cycle time of 27.24 seconds and a production of 132 manifolds per hour at 100 per cent efficiency.

The second new machine for intake manifold processing, illustrated in Fig. 12, is an eight-station, horizontal rotary indexing machine made by the Michigan Special Machinery Co. At successive stations on this machine, the water-outlet pads and carburetor mounting pads on the manifolds are rough- and finish-milled, seven holes are drilled and countersunk in each casting, and five holes are tapped.

Two new machines for the camshaft production line have been designed to handle parts for both the V-6 and V-8 engines. One of these is a Lamb seven-station transfer machine, Fig. 13. The camshafts—either for the V-6 or V-8 engines—are loaded, machined, and unloaded two at a

time, with double-spindle heads being provided on both the left- and right-hand sides of the machine at all operating stations. Keyways are cut in the shafts by cutters mounted on the spindles of the left-hand head at Station 2. The right-hand head at the third station is equipped with two drills, 0.125 inch in diameter, for drilling a hole at an angle of 33 degrees through the flange of each camshaft. A hole 0.3906 inch in diameter by 1.34 inches deep is drilled in the end of each shaft on the left-hand side at the fourth station. The left-hand head at Station 5 is equipped to probe and blow out (with blasts of air) the holes drilled in the ends of the castings. A hole 0.1875 inch in diameter is drilled through the No. 4 bearing in each shaft with the right-hand head at the fifth station. The shaft-end holes are tapped (7/16-20 threads) and the other holes are probed at Station 6. Drills are rotated at 70 sfpm and fed at the rate of 6 ipm. The keyway cutters rotate at 60 sfpm and are fed at 4 ipm, while the taps revolve at 30 sfpm and feed at 13.1 ipm. Cycle time is 15 seconds, permitting a production of 240 camshafts per hour at 100 per cent efficiency.

The Impco machine for polishing the bearing surfaces on the camshafts is also designed to handle parts for either the V-6 or V-8 engines. By means of a universal work-holding fixture, both the cast-iron V-6 and aluminum V-8 engines are accommodated on the same final assembly line.

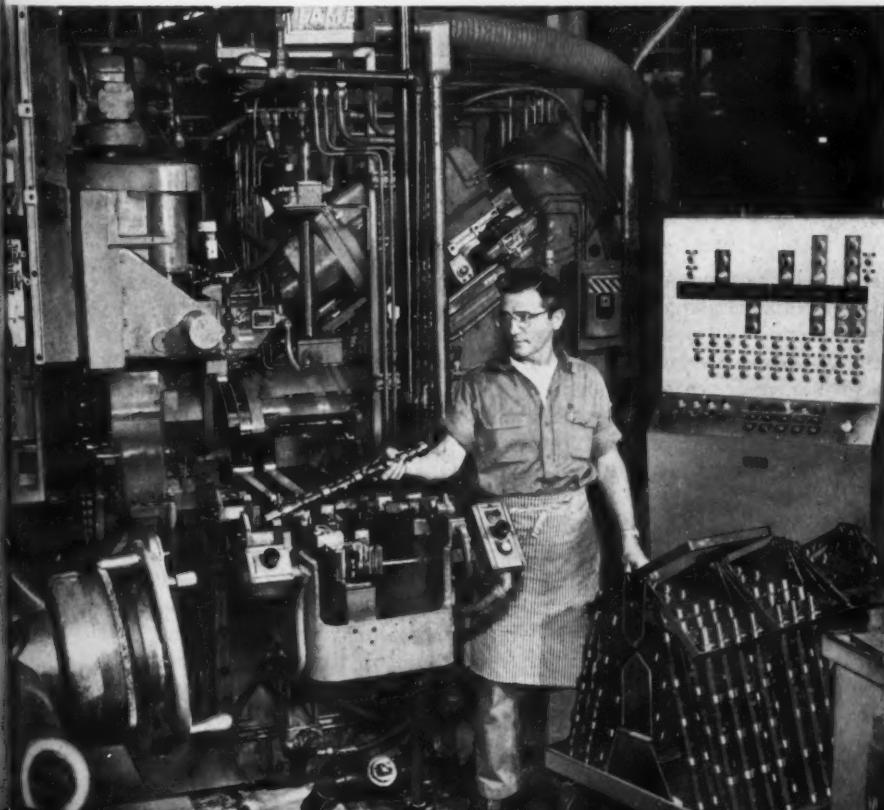
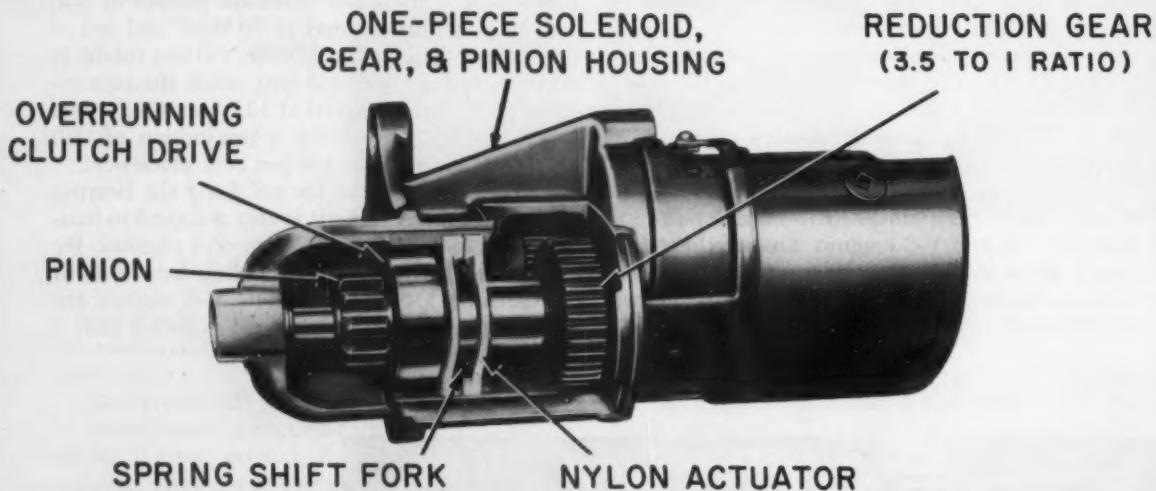


Fig. 13. Camshafts for either the V-6 or V-8 engines are processed two at a time, with outputs up to 240 per hour, on this transfer machine.

Transfer machining of



REDUCTION GEAR STARTING MOTOR (Reduction Gear Side)

AN entirely new starter, which is standard on all Chrysler Corporation 1962 passenger cars, features built-in reduction gearing and positive engagement. The starter is smaller in size and 5 pounds lighter than the former direct-drive starter. The reduction-gear set gives a ratio of 3.5 to 1 between the armature and the ring-gear drive pinion, providing a total ratio of 45 to 1 between the armature and the engine crankshaft. Greater starting torque is provided at low cranking speeds, and reduced current draw under heavy loads.

Efficient design and the use of 15 per cent fewer parts made it possible to hold the starter weight to only 15 pounds. For example, the solenoid cover and brush holder are now a single

plastic part, which replaces twenty-eight separate components found in previous starters. Another major factor in reducing the weight is the use of a one-piece, die-cast aluminum housing, shown in the cutaway view of the starter (heading illustration), for enclosing the solenoid, reduction gear, pinion, and overrunning clutch drive.

Aluminum housings (from Chrysler's Kokomo die-casting plant) for the reduction-gear starters are completely processed on two machines made by the Baush Machine Tool Co. One is a six-station rotary indexing machine, and the other, a twenty-two-station in-line transfer machine. The maximum cycle time on these machines is 0.35 minute, resulting in a production (since two parts

Chrysler's new

STARTER HOUSING

Die-cast aluminum housings for reduction-gear starters are completely processed on a rotary indexing and an in-line transfer machine. Features of

the machines include static controls; ball-bearing screw type, mechanical-feed units; and automatic assembly and burnishing of bushings.

SHELDON F. WOODARD

Manager of Manufacturing Engineering

Electrical Equipment Plant

Chrysler Corporation, Indianapolis, Ind.

are handled in each station at the same time) of 342 parts per hour at 100 per cent efficiency. Both machines are equipped with static controls such as magnetic amplifiers and other static devices which are not subject to wear or erosion. This extends the life of the controls and reduces maintenance and down time.

Another feature of these machines is that all the heads are equipped with highly efficient, ball-bearing screw type, electromechanical power feed units. A rapid-traverse motor drives the ball-bearing lead-screw, and a feed motor drives the recirculating ball nut for feeding against a positive stop. This arrangement provides a smooth, positive, and constant feed rate, with no slow-down or surge as the result of variations in the

material or when the tools break through the work-pieces. Longer tool life is another major advantage. Also, there is less maintenance and down time because of the elimination of hydraulic problems and leakage.

A third factor which has minimized down time, and also substantially reduced setup time, is the use of DeVlieg Microbore preset tooling and quick-change holders throughout the machines. These tools have micrometer-vernier adjustment, and are used for all single-point boring, turning, and facing operations. Carbide Industry Standardization Committee Type C₆ carbide is employed. Tool lives between sharpenings of up to 9000 work-pieces have been obtained for some of the boring operations.

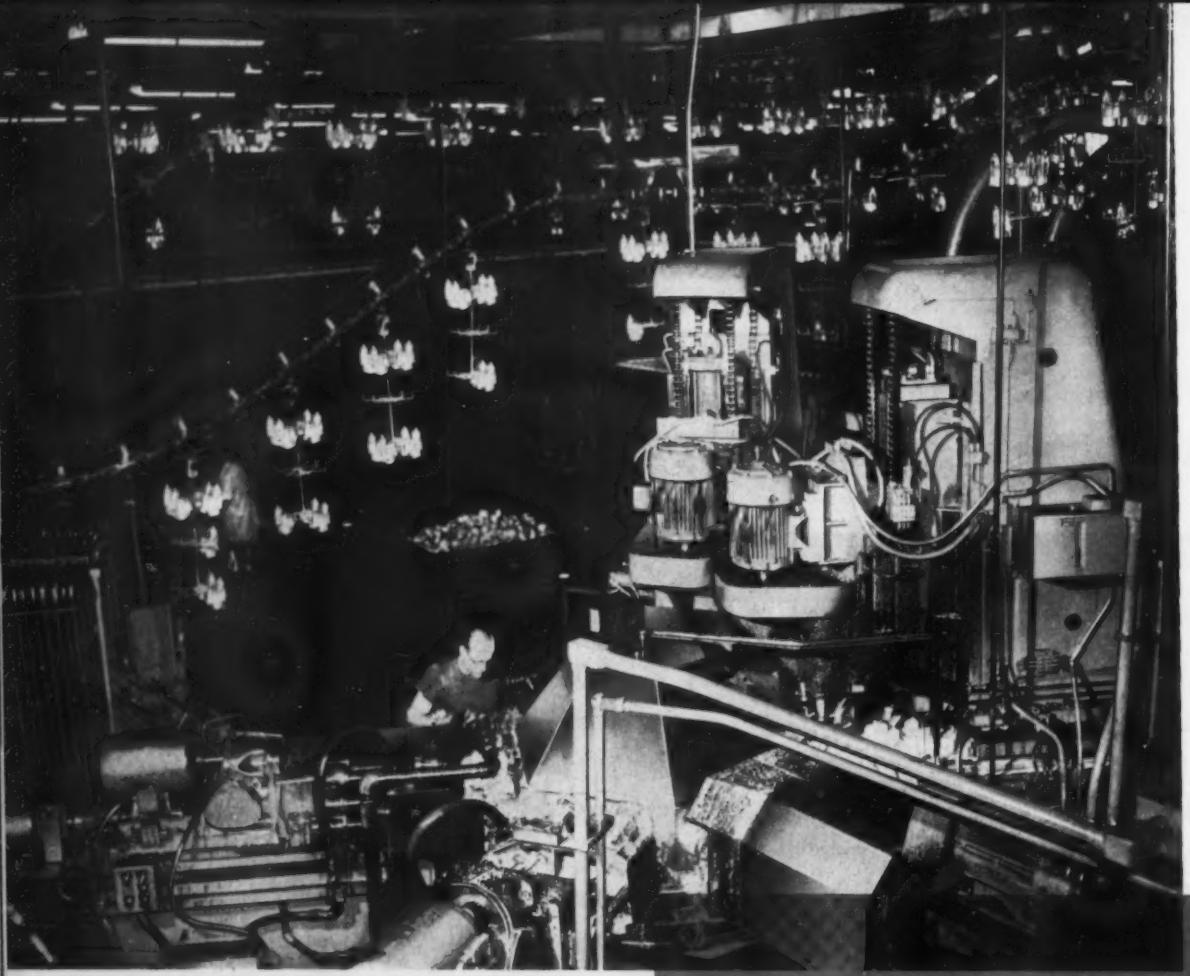
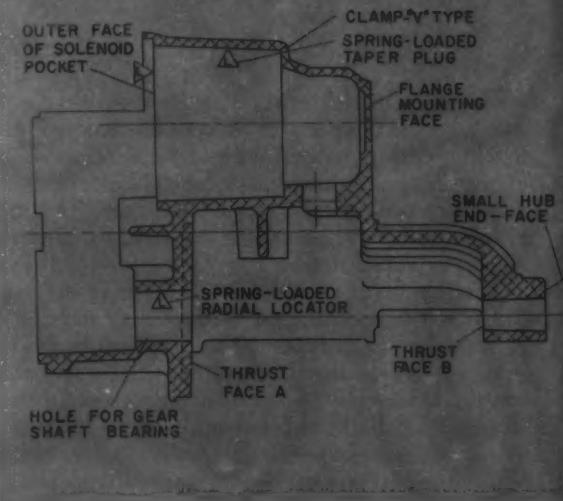


Fig. 1. On this six-station rotary indexing machine the thrust faces, small-hub end face, flange mounting face, and two holes are machined.

After inspection of the die-cast aluminum housings, they are manually loaded, two at a time, at the first station of the six-station rotary indexing machine shown in Fig. 1. The castings are located against the outer faces of the solenoid pockets, Fig. 2, over spring-loaded taper plugs that extend into the pockets. Radial location is accomplished with spring-loaded taper pins that enter the holes for the gear-shaft bearings. When the operator presses the start button, both parts are automatically clamped and the fixture is indexed to the first machining station.

At the second and third stations, thrust surfaces *A* and *B* (Fig. 2) are faced with special four-flute, solid-carbide end mills held in Jacobs chucks with Rubberflex collets. The end mills are rotated at 2300 rpm (357 sfpm) and fed at the rate of 0.006 ipr (13.8 ipm). At Station 4, the flange mounting face with a connecting fillet, and the end face of the small hub on each housing, are generated with single-point turning and

Fig. 2. Starter housings are located by spring-loaded taper plugs in the solenoid pockets and taper pins in the gear-shaft bearing holes.



facing tools. These tools are rotated at 1400 rpm, providing a maximum cutting speed of 3660 sfpm, and fed at the rate of 0.008 ipr (11.2 ipm).

At Stations 5 and 6, two mounting holes in each housing are drilled and reamed to diameters of 0.4530 and 0.5810 inch. These holes are reamed to a tolerance of plus 0.0000, minus 0.0005 inch, to serve as locating surfaces on the in-line transfer machine. The high-speed-steel drills, having "fast-spiral," polished flutes, are rotated at 120 sfpm and fed at the rate of 9.78 ipm. The four-and six-flute, carbide-tipped reamers, held in Ziegler floating holders, are fed at the same rate as the drills, but rotated at 80 sfpm. When the fixtures are again indexed and returned to the first station, the two housings are manually unloaded and placed in a container on a roller conveyor leading to the transfer machine.

On the twenty-two-station in-line transfer machine, an operator loads the returning pallets onto the indexing table. He unloads two completed housings from the work-holding fixtures on each pallet, and places them on hangers, Fig. 3, suspended from an overhead monorail conveyor that carries them to the assembly department. Then, he manually loads two castings from the rotary indexing machine, locating each part by means of a diamond pin and a round pin locator that enter the previously reamed holes. At the second station, the parts are automatically clamped with a power-wrench assembly, the



Fig. 3. At the unloading and loading station of the twenty-two-station transfer machine, completed housings are placed on conveyor.

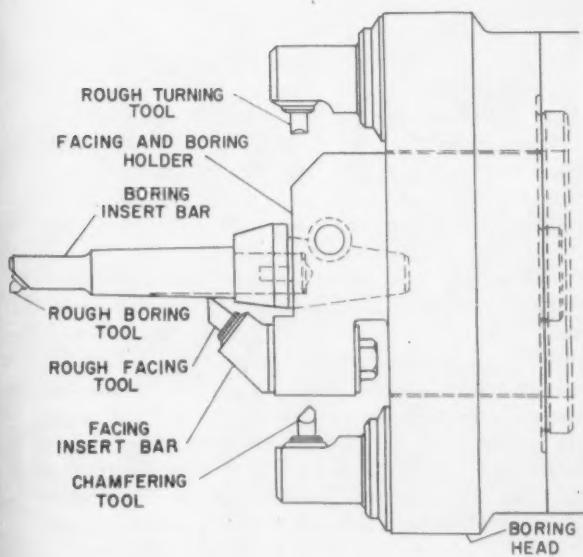


Fig. 4. One of the two sets of tooling at Station 7. The quick-change holders have preset, vernier-micrometer adjustable tooling.

clamps acting on the lugs directly behind the locators.

The right-hand head (on the operator's side of the machine) at Station 3 is tooled to drill three holes in each of the two housings. Two of the holes are drilled by a single subland drill, 1/2 and 25/32 inch in diameter. The other hole in each part, 0.136 inch in diameter, is made with a separate No. 29 twist drill. Both drills are fed at the rate of 16 ipm. The subland drill rotates at 105 and 145 sfpm, while the smaller-diameter drill revolves at 110 sfpm. Two more holes, 0.201 inch in diameter, are drilled in each part, and a third hole, 0.147 inch in diameter, is reamed by tools mounted on the right-hand head at the fourth station.

Station 5, as well as Stations 16 and 19, on the in-line transfer machine have been left idle to take care of possible changes in the design of the housings, with the resultant need for additional tooling. The small-hub ends of the cast-

ings are rough-bored, turned, and chamfered by an end mill and single-point tools on the left-hand head at the sixth station. The right-hand head at the same station is tooled to rough-bore and chamfer the other gear-shaft bearing hole.

Typical of the quick-change holders, with preset and vernier-micrometer adjustable tooling, is the head shown in Fig. 4, two of which are mounted on the right-hand side of the machine at Station 7. These tools rough-turn, face, and bore, as well as chamfer the castings. The heads are rotated at 5091 rpm, which provides cutting speeds of 750 to 1000 sfpm, and fed at the rate of 10.18 ipm (0.002 ipr). At the eighth station, the pallets are automatically rotated 90 degrees to permit drilling and reaming cross-holes in the housings.

Both the left- and right-hand heads at Stations 9 and 10 are tooled to drill five holes and ream two holes in each housing. The drills, 0.177 and 0.203 inch in diameter, are rotated at 90 sfpm, and fed at the rate of 9 ipm. The reamers, 0.2187 inch in diameter, are fed at the same rate, but revolve at 60 sfpm. At the eleventh station, the pallets are again rotated 90 degrees in a horizontal plane, returning the parts to their original positions.

A unique arrangement for transfer machines is provided at Station 12. Here, a cross-over arrangement, Fig. 5, permits the unloading and reloading of pallets with parts that have been processed through the first eleven stations. This is done only in the case of emergency or breakdown of the machine, or for planned maintenance operations. When used, the partially processed castings are unloaded and stored, and the empty pallets are returned to the first station. Then, when the maintenance or repair operations have been completed, the stored parts are reloaded and indexed through the remainder of the machine. Provision of this station also permits visual inspection of the work-pieces during normal machine operation. A power-wrench assembly is located at Station 13 to reclamp the parts when required.

The left- and right-hand heads at Station 14 are used to semifinish-bore two holes in each casting, and finish turn, face, and chamfer adjacent surfaces. Another hole is semifinish-bored, and additional surfaces are finish-turned and faced, with tools mounted on the right-hand head at Station 15. The combination tool-heads at these stations are fed at the rate of 10.18 ipm while being rotated at cutting speeds varying from 905 sfpm up to 2170 sfpm.

At Station 17, both the left- and right-hand heads are equipped with carbide-tipped reamers to finish two holes in each casting to a diameter between 0.5935 and 0.5943 inch, and one hole to

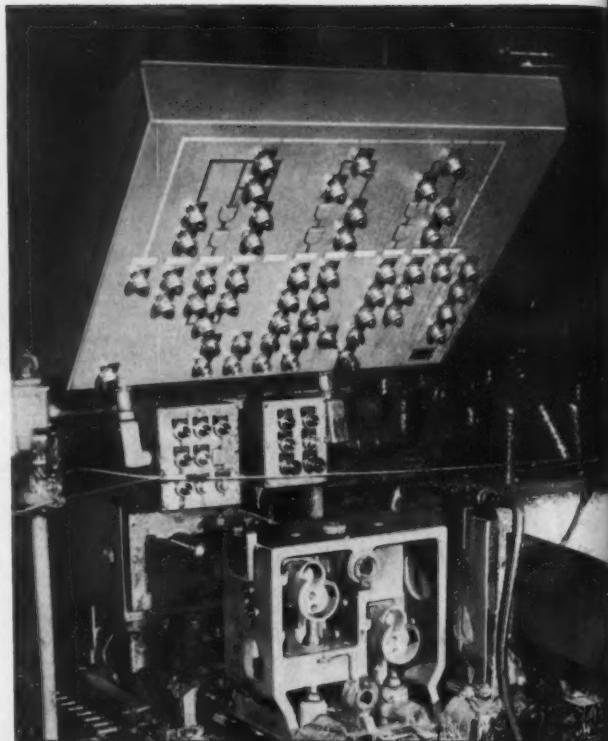


Fig. 5. Cross-over arrangement at Station 12 permits interrupting production on half the machine for planned maintenance or repair operations.

a diameter from 0.8115 to 0.8123 inch. The reamers, mounted in Ziegler floating holders, operate at a cutting speed of 60 sfpm and a feed of 10.18 ipm. Two mounting holes are tapped (1/4-20 threads, UNC-2B) to a depth of 0.690 inch in each housing, with the right-hand head at Station 18. The "spiral-fluted" taps, in floating tool-holders, are rotated at 750 rpm (50 sfpm) and fed at the rate of 0.050 ipr (37.5 ipm).

Amplex Oilite bearings are automatically pressed into the starter housings and burnished to size at Stations 20 and 21. Two of the oil-impregnated, bronze powder metallurgy bearings are inserted in each housing at the twentieth station, one by means of the left-hand head and the other with the right-hand head. The third bearing is assembled in each part with the right-hand head at Station 21. Bearings are automatically supplied to the heads through chutes from a vertical storage unit, Fig. 6, made by the Leading Engineering & Mfg. Co., Pontiac, Mich. The combination pressing and burnishing rams on each head, as shown close up in Fig. 7, are equipped with burnishing tools, each having three carbide buttons.

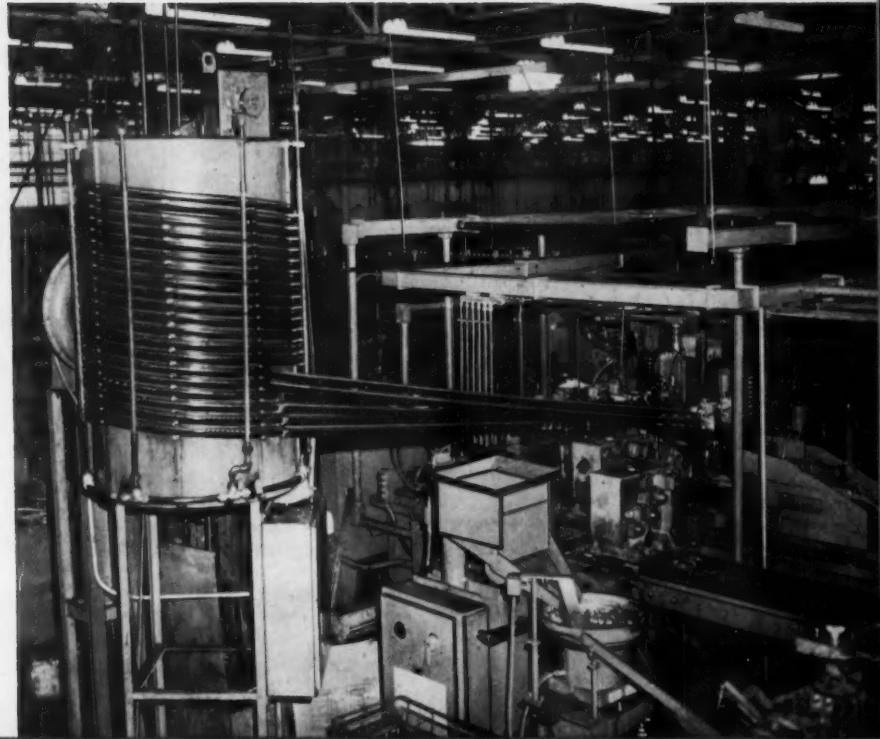


Fig. 7. (Below) Close-up view of stations where bearings are pressed into the starter housings and then burnished to required size.

Fig. 6. (Above) Chuting from this vertical storage unit supplies oil-impregnated, sintered bronze bearings to assembly stations on the machine.



One size bearing has a bore between 0.6865 and 0.6875 inch in diameter, and an outside diameter of 0.8135 to 0.8140 inch before pressing and burnishing. The reamed bearing hole in the housing has a bore of 0.8115 to 0.8125 inch in diameter, while the three successive buttons on the burnishing tool have diameters of 0.6870, 0.6865, and 0.6860 inch. On the forward stroke of the ram, pressing of the bearing into the reamed hole reduces the diameter of the bearing from 0.0010 to 0.0025 inch, resulting in a bearing bore about 0.6850 inch in diameter. On the return stroke of the ram, the burnishing action of the carbide buttons produces a bearing bore about 0.6868 inch in diameter.

At Station 22, the pallets, each holding two completely machined starter housings, are automatically indexed to a conveyor. The conveyor transports the parts past an air blast which blows out the two tapped holes through a blast-cleaning operation for deburring the castings, and into an in-line washer and dryer that removes the soluble-oil coolant and chips. Then, the pallets are returned to the first station of the transfer machine for unloading of the completed housings.

An automated system for handling, storing, and distributing pistons has facilitated the balancing of production from various machines having different output rates. Also, quality of the pistons has been improved, down time reduced, and floor space conserved. The flexible system can easily be modified to accommodate pistons of different size and shape

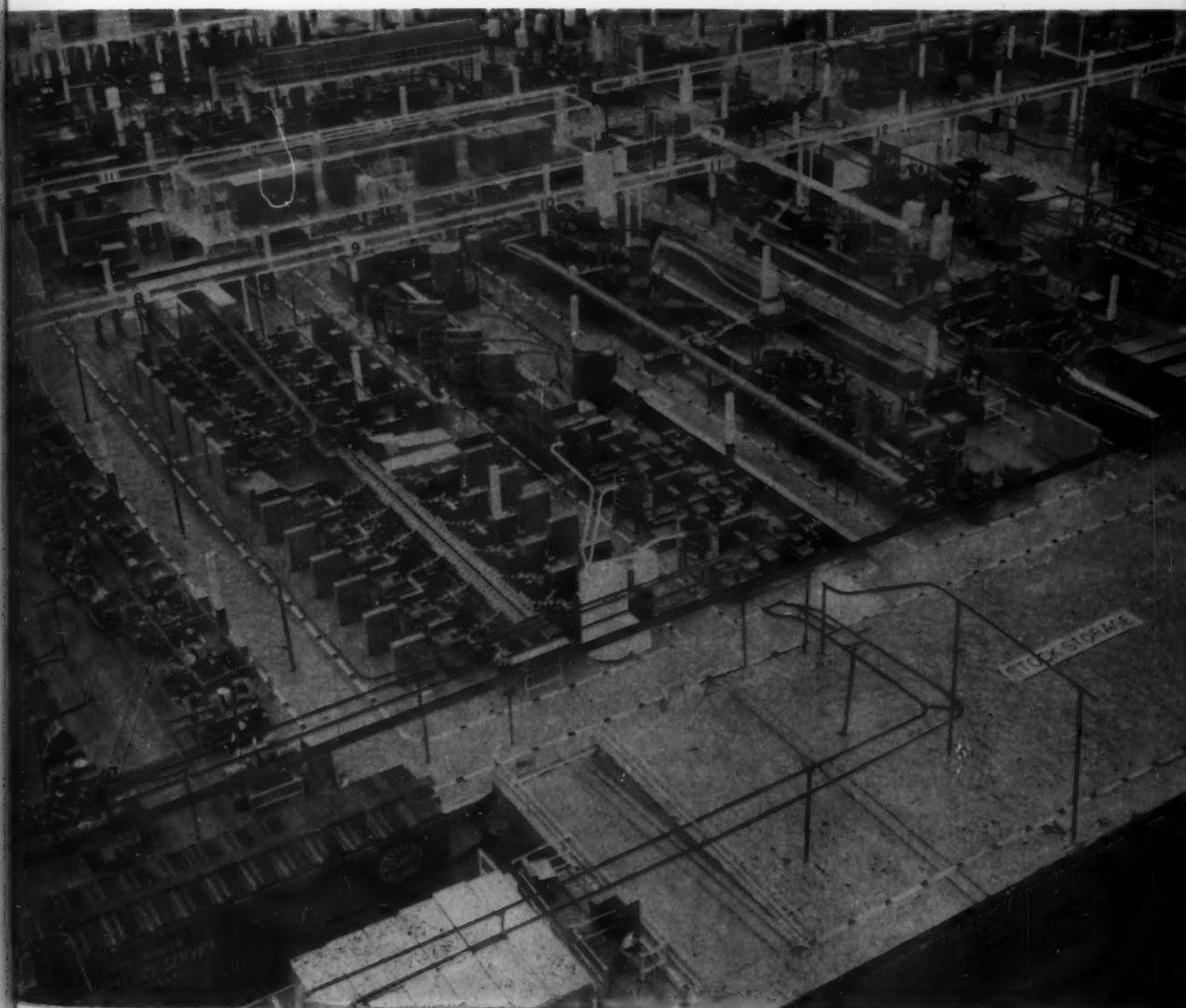
Improved piston handling at Oldsmobile balances production and increases flexibility

CAREFUL PLANNING by Oldsmobile engineers and a thorough investigation of all types of equipment on the market have resulted in a new automated piston-handling system that offers many benefits. In addition to coordinating and controlling the flow of pistons to and from the individual machines, the system provides temporary storage units between machines having unbalanced production rates. Also, down time has been reduced, floor space conserved, and the quality of the pistons improved. Another important advantage is that components of the system can easily be modified to take care of possible changes in product design, permitting the handling of flat or dished head pistons having a different size or shape.

As part of the comprehensive planning program, three-dimensional models of the production machines and piston-handling system were mounted on a scale layout of the plant, as seen in Fig. 1. This permitted the engineers to visualize the flow of the parts, and accurately determine floor and overhead space requirements without the need for delays or interruptions in production after installation of the equipment. The models painted white were those still to be installed when the photograph was taken.

After the cast aluminum-alloy pistons have been inspected, they are manually loaded on a six-tier, double-row roller conveyor, Fig. 2. Each row on every tier leads to an individual Sundstrand automatic stub lathe. These twelve lathes,

Fig. 1. Three-dimensional models of production machines and piston-handling system assist in planning an optimum layout at General Motor's Oldsmobile Division, Lansing, Mich.



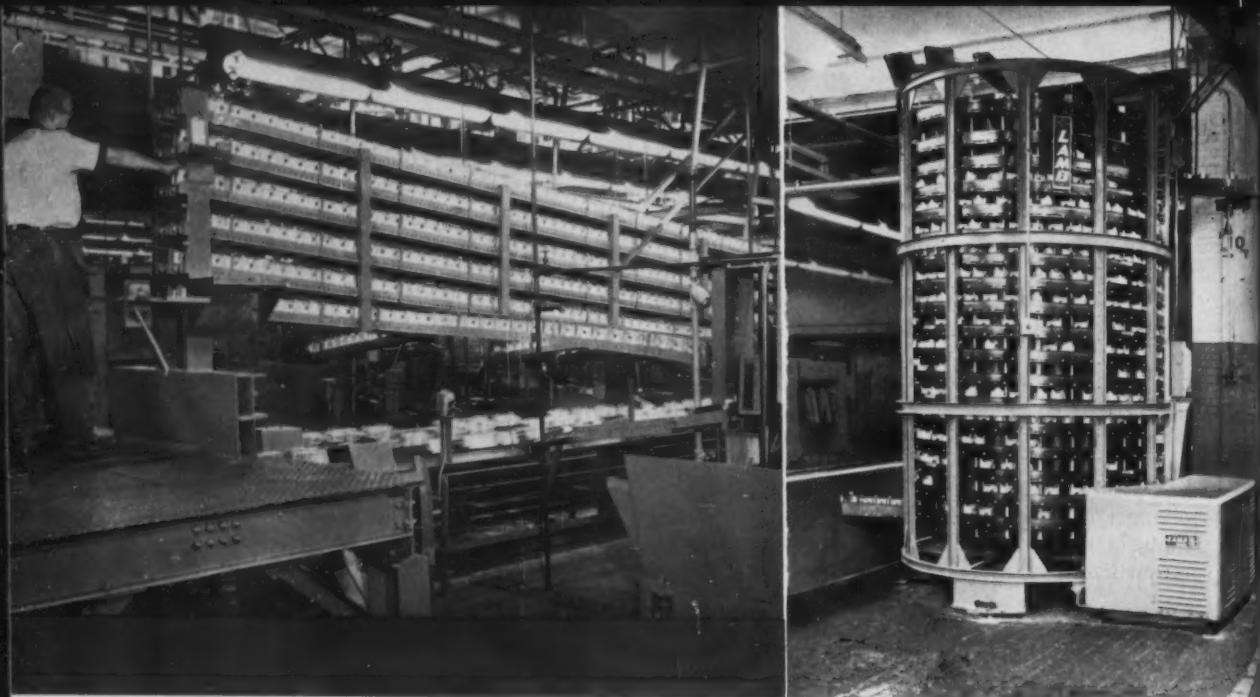


Fig. 2. Six-tier, double-row roller conveyor carries the pistons to automatic lathes, where they are center-drilled, faced, and chamfered. Each row leads to an individual lathe.

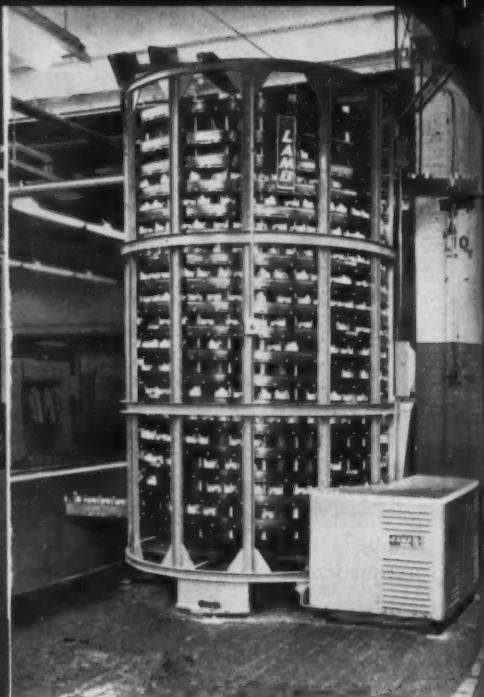


Fig. 3. Elevating and storing unit, having a capacity of 1000 parts, in which pistons are raised in a helical path from bottom to top.

six of which are located along each side of the conveyor, are used to center-drill the closed ends of the pistons, and face and chamfer the weight bosses and skirt ends. Hydraulically operated units are provided on the lathes for automatic loading and unloading.

Machined pistons are automatically unloaded onto a recirculating chain type power conveyor, seen at the bottom in Fig. 2, which carries them up an incline for loading into a second group of twelve Sundstrand automatic stub lathes. Here, the closed ends of the pistons are finish-turned; the ring grooves are rough- and finish-turned, and chamfered; and the outer surfaces are semifinish-turned.

Pistons automatically unloaded from these lathes slide onto a steel-belt conveyor, from which they are diverted into the bottom of a helical elevating and storing unit (Fig. 3) made by Fab-Tec, a subsidiary of F. Jos. Lamb Co., Detroit, Mich. Movement of the pistons in a helical path from the bottom to the top of this unit, which has a capacity of 1000 parts, is accomplished by nylon-bristle brushes and rubber flaps attached to a spider rack mounted on an adjustable-speed, motor-driven center column. By varying the speed, the feed rate out of the storage unit can be adjusted from 1100 to 3300 pistons per hour.

Fab-Tec chuting in the storage unit, as well as that used to and from the machines, is equipped

with roller bearings over which the pistons roll. In moving along the chute, the pistons must overcome the inertia of the bearings, thus reducing their velocity and minimizing any chance of damage when they contact each other. Also, all the chuting was installed with a pitch of approximately 1/2 inch per foot to avoid high velocities and the possibility of damaging the pistons.

Side rails of the chuting are made from blue-tempered, rolled-edge spring steel, which conforms to a natural radius when bent at installation. A uniform cross section is maintained by spacers, and the side rails are held together with standard bolts, nuts, and washers. The rails have elongated openings to facilitate assembly. All that is necessary to handle different diameter pistons is to add or remove spacers and use longer or shorter bolts.

Flow of the pistons out of the elevating and storage unit into one of three feed-chutes is controlled by a three-way distributing head located at the discharge terminal. The head is electrically connected to three Fab-Tec helical, gravity flow-down part-lowering units, each of which is located near the loading station of an Impco seven-station transfer machine. By the use of high- and low-level line switches, these helical lowering units also serve as individual storage banks, each having a capacity of accumulating approximately 200 pistons.

Pistons are automatically fed from the 1000-part capacity storage unit to the 200-piece capacity unit at the first transfer machine. When there are sufficient pistons stacked in the helical lowering unit to trip the high-level switch, the distribution head automatically diverts parts to the second machine, and then the third. When all three high-level switches have been actuated, indicating a full storage condition at each machine, pistons are held in the main elevating and storing unit. Then, additional parts are discharged from the main unit only on demand—when an open, low-level switch on one of the helical lowering units indicates that production has depleted its supply of pistons.

With this arrangement, production is balanced between the twelve automatic lathes and the three transfer machines. The system also permits shutting down certain machines for maintenance, repair, or tool changes without the need for interrupting the full production line. Another major advantage is that maximum storage capacity is provided with a minimum of floor space.

On the transfer machines, two holes, 5/16 inch in diameter, are drilled in each piston, and the

wrist-pin holes are rough-bored and chamfered. Attached to the end of each transfer machine is an Olofsson vertical milling unit for removing the center bosses and machining a recess in the head of each piston. As the parts leave these machines, Fig. 4, they are rotated to dump chips and coolant, and are reoriented so that they are deposited on a steel-belt conveyor in a "heads-down" position. This is accomplished with simple, twisted wire rod scrolls.

From the flat steel-belt conveyor, the pistons are diverted into the bottom of another Fab-Tec elevating and storing unit having a 1000-part capacity, seen at the right in Fig. 4. A three-way distributing head, as well as three feed-chutes, are also provided at the discharge terminal on top of this unit. The pistons are fed on demand to 200-part capacity, gravity lowering units, Fig. 5, located at each of three Snyder automatic piston-balancing machines. An escapement mechanism, Fig. 6, permits only one part at a time to enter the automatic machine loader, thus avoiding excessive back pressure from the stack of pistons. On these nine-station machines, the pistons are rotated to orient their skirts, turned over

Fig. 4. After machining a recess in each head, and removing their center bosses, the pistons are reoriented into a heads-down position and deposited on a steel-belt conveyor.

Fig. 5. Pistons are fed by gravity on these combination lowering and storing units, to feed automatic balancing machines.

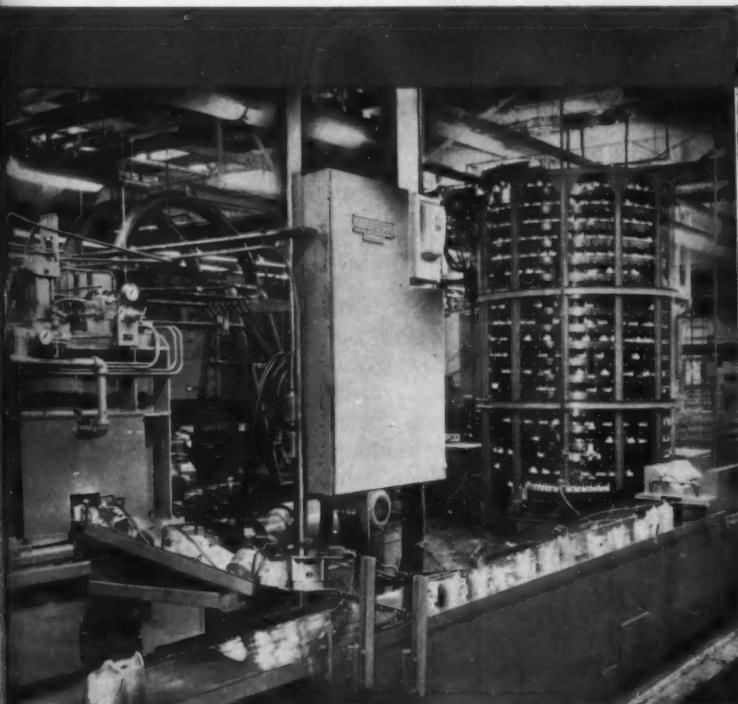


Fig. 6. Balancing machine is automatically loaded one part at a time by means of an escapement mechanism to avoid pressure from stack of pistons.



Fig. 7. Machines for cam-grinding the piston skirts are supplied with parts from 200-piece capacity, gravity-fed lowering units.

into a "heads-up" position, weighed to preset the milling cutters, milled on the balancing bosses to the required weight, reweighed, and unloaded.

The production rate of the preceding pin-boring machines is about 400 pistons per hour less than that of the balancing machines. To offset this unbalanced condition, the boring machines can be operated an extra hour in the morning (before the first shift), and another hour at mid-day (during the lunch hour). In this way,

a surplus can be built up in the storage units, without any problems in handling the extra parts.

After balancing, the pistons are carried on a flat steel-belt conveyor to another 1000-part capacity elevating and storing unit. From this unit, the pistons are transferred to an overhead belt conveyor, which supplies 200-part capacity, gravity lowering units, Fig. 7, located at each of ten Cincinnati hydraulic grinding machines. Here, the outer surfaces of the piston skirts are cam-

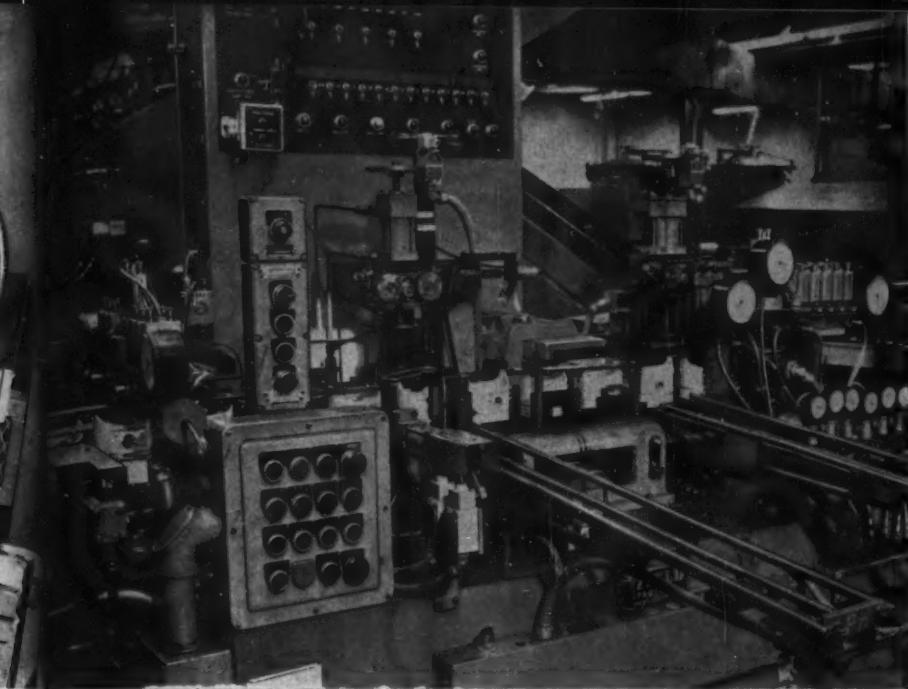


Fig. 8. Automatic gaging and segregating machine checks various dimensions of the piston grooves, lands, skirts, and heads.

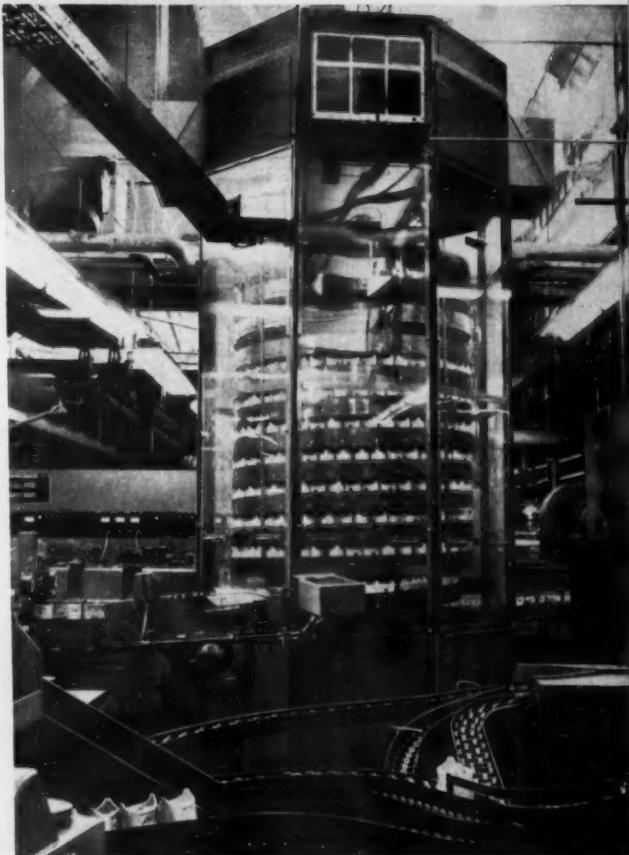
Fig. 9. (Right) Double-row, gravity lowering storage unit has a capacity for 2000 pistons. The unit is enclosed to control part temperature for final inspection.

ground. For this operation, the coolant solution of soluble oil and water is filtered and refrigerated.

Ground pistons are carried by a steel-belt conveyor to a Ranshoff washing machine and blow-off unit. Then the parts pass through a Stevens fully automatic tin-processing machine. Plated pistons are automatically loaded into the Sheffield gaging and segregating machine shown in Fig. 8. Here, the widths, diameters, location, and parallelism of the grooves, diameter of the lands, squareness of the skirt, and thickness of the heads are automatically inspected. Unacceptable pistons are automatically ejected into reject chutes according to type of defect.

Inspected pistons are transported by a steel-belt conveyor to a fourth 1000-part capacity elevating and storing unit. The pistons are then carried by an overhead belt conveyor to six 200-piece capacity, gravity lowering units, which supply Ex-Cell-O six-station transfer machines. Here, the wrist-pin holes are grooved, semifinish-and finish-bored (to a tolerance of plus or minus 0.0002 inch), and gaged.

A steel-belt floor conveyor then carries the pistons through another washing machine and blowoff unit to the bearingizing machines. Bearingized parts are weighed and moved by an inclined-belt conveyor to the enclosed, gravity lowering storage unit seen in Fig. 9. This unit has two helical chutes, side by side, thus providing storage for 2000 pistons. Temperature within the



unit is maintained at 70 degrees F. for uniformity during final inspection. Final inspection is performed on Sheffield or Arlin (now RCA) automatic gaging and classifying machines.



Fig. 1. Onion-head shaped bulges are formed on one end of intake-valve blanks by gathering metal on this machine.

45,000
intake valves
a day
from Ford's Northville plant

Metal gathering, hot-forming, induction hardening, aluminizing, and automatic inspection are among the interesting operations performed in producing intake valves to precise tolerances

CHARLES H. WICK, Midwestern Editor

TEN different intake and exhaust valves for Ford's line of cars and trucks are produced at the company's engine and foundry division in Northville, Mich. Highest quality standards and precise tolerances are demanded for these critical engine components. To accomplish this the plant is equipped with some of the latest in production and inspection equipment.

Intake valves are produced from SAE 1047 steel bar stock. The material is of special cold-heading quality having a minimum hardness of 20 Rockwell C. Engineering approval of samples from each shipment of material is required prior to production, and seams on the bar surfaces must not exceed 0.0005 inch.

Bar stock for the intake valves is received in 6000-pound bundles of 12-foot lengths. The bars are sheared to the required lengths, two at a time, on a Ferracute press. Blanks must be straight, from end to end, within 0.005 inch, total indicator reading, and their ends square with the axis within 0.015 inch. Diameters are maintained to plus or minus 0.0015 inch, and lengths to plus or minus 0.010 inch, of the specified dimensions. The sheared blanks are washed to remove oil and any foreign material.

An "onion-head" shaped bulge is then formed on one end of each formed blank on Taylor-Winfield metal-gathering machines. Washed blanks are automatically loaded from a hopper into a vertical position on a four-station indexing work-

fixture, Fig. 1. At the rear station, electrode jaws close on the upper end of the blank, and pressure is applied to the bottom end to push the blank through the jaws. The upper end contacts an electrode anvil, and is heated by electrical resistance to between 2000 and 2100 degrees F. Continuing pressure forms the desired onion-head. At the next station, the parts are automatically ejected into tote boxes, where they are allowed to cool to room temperature.

In the next operation, Fig. 2, the onion-head ends of the intake-valve blanks are heated to 2050 degrees F. by means of a Westinghouse induction-heating unit, seen at the left. Heated blanks are automatically ejected from the rotary work-holding fixture, and slide down a chute. Here, the operator of a 500-ton Bliss press picks up each blank with tongs and places the stem end into the die cavity. An impact is exerted on the blank to hot-form the valve head. Flash is held to a maximum of 0.020 inch, and runout must not exceed 0.010 inch, total indicator reading. A mixture of graphite and oil is used as a lubricant and parting agent in this hot-working operation.

Formed valves are automatically lifted from the die, dropped on a chute, and conveyed to a washer, where the forging lubricant is removed. From the washer, the parts are automatically loaded into furnace pots, each holding 1600 valves, which are placed in Leeds & Northrup electrically heated furnaces for annealing. When

Fig. 2. Intake-valve blanks are induction-heated on unit at left, and forged on press at right, to form the valve heads.



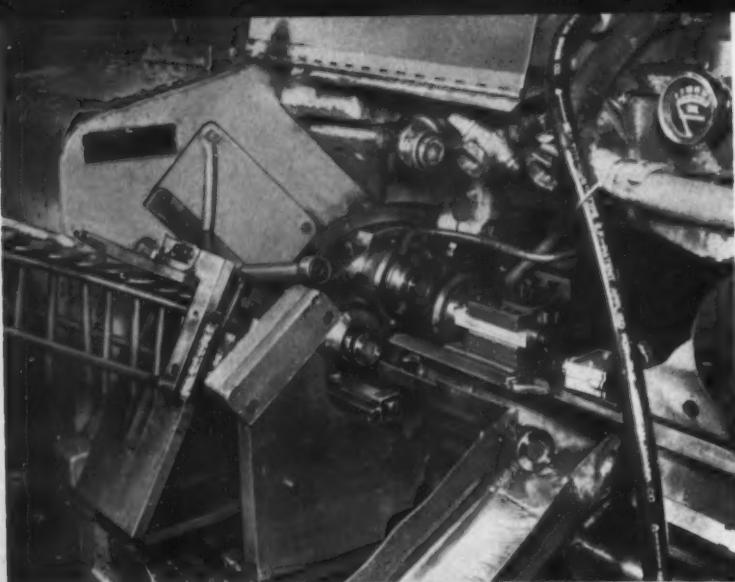


Fig. 3. Valve heads are turned, faced, and chamfered on this six-station chucker, which is automatically loaded and unloaded.

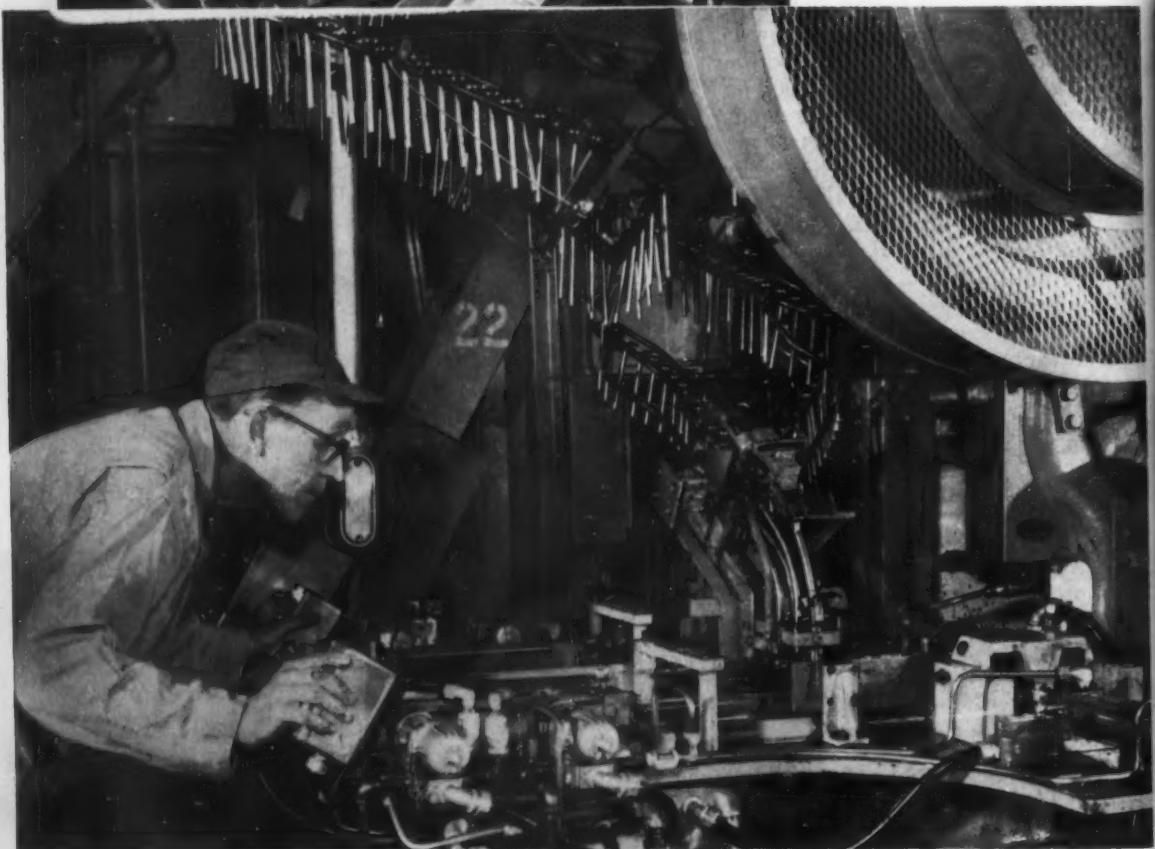


Fig. 5. Valve feet are hardened to 50 Rockwell C, for a distance of 0.120 inch from the stem ends, on this induction-heating unit.



the temperature in the furnace reaches 1050 degrees F., the valves are removed and allowed to cool to room temperature. This heat-treatment assures a maximum hardness of 30 Rockwell C, and facilitates subsequent machining. The valves are then tumbled and shot-blasted in a Pangborn Blastmaster to remove forging scale. Steel shot-blast pellets are used for this operation.

Turning, facing, and chamfering of the valve heads are performed on New Britain six-station automatic chucking machines, such as the one shown in Fig. 3. The valves are automatically fed to the machines from hoppers and chuting, and loaded at the first station. Location is from the

surface under the valve head. At the second station, the heads are rough-turned and the seats semifinish-turned. Finish turning of the heads is done at Station 3, and finish-facing and chamfering, at the fourth and fifth stations. From 0.015 to 0.035 inch of stock is removed from the various surfaces, using tungsten-carbide-tipped tool bits. The valves are automatically ejected and unloaded from the machines at the sixth station.

Forged intake valves must be sheared, broached, and ground to length. Both rough shearing and broaching are done two parts at a time on V & O presses. In rough shearing, from 0.288 to 0.394 inch of stock is trimmed from the stem end, holding the length to plus or minus 0.003 inch. In broaching, Fig. 4, about 0.030 inch of stock is removed, and a tolerance of plus or minus 0.0015 inch is maintained on the specified length. Combination air-hydraulic cylinders are used to automatically load and unload the presses.

After rough-grinding the stems on Landis centerless grinding machines, the stem ends are hardened on a Lindberg induction-heating machine, Fig. 5. Parts are supplied from an overhead conveyor, the valves sliding down an inclined chute and being automatically loaded on the continuous work-holding fixture. The valves are rotated as they pass through the induction coil. Then they are quenched in oil and automatically ejected onto an elevator. This heat-treating operation produces a minimum surface hardness of 50 Rockwell C for a distance of about 0.120 inch from the stem end.

Retainer grooves (also called keeper slots) are ground in the valve stems and the feet are chamfered on Cincinnati centerless grinding machines. Valves are automatically unloaded from an overhead conveyor, slide down an inclined chute to the machine loader, and drop onto the work-rest blade. A vitrified-bond, aluminum-oxide grinding wheel, 24 inches in diameter by 1/2 inch wide, having 80 grain size and a 9 structure, is used for this precision form-grinding operation. The wheel is dressed to the required contour, including a 0.013-inch radius and 30-degree angle, by means of a cemented-diamond forming-cutting wheel.

Valve faces are ground on Landis angular-head, cylindrical grinding machines such as the one seen in Fig. 6. The parts are automatically loaded on ram type carrier and loading devices which transfer the valves and insert their stem ends into the revolving collet assemblies of the machines. After grinding the faces, the valves are automatically ejected.

End faces of the valve feet are finished on Gardner two-spindle grinding machines. The valves are automatically loaded on the work-holding fixtures of a twenty-one station rotary drum, locating from their finish-ground faces and

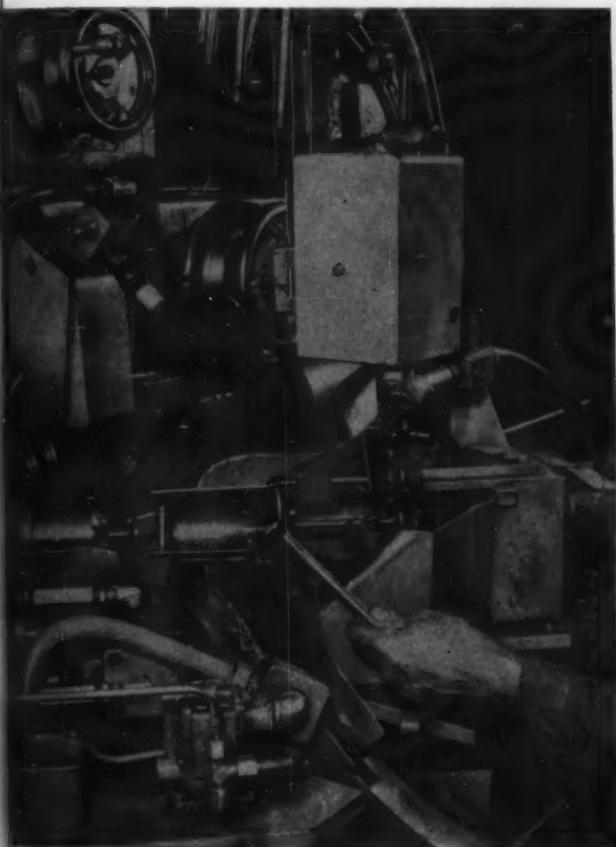


Fig. 6. (Above) Angular-head, cylindrical grinding machine for finishing the valve faces is automatically loaded and unloaded.

Fig. 4. (Facing page, center) Two sets of broaching tools are mounted on the ram of this press to remove about 0.030 inch of stock from two valve feet at a time.

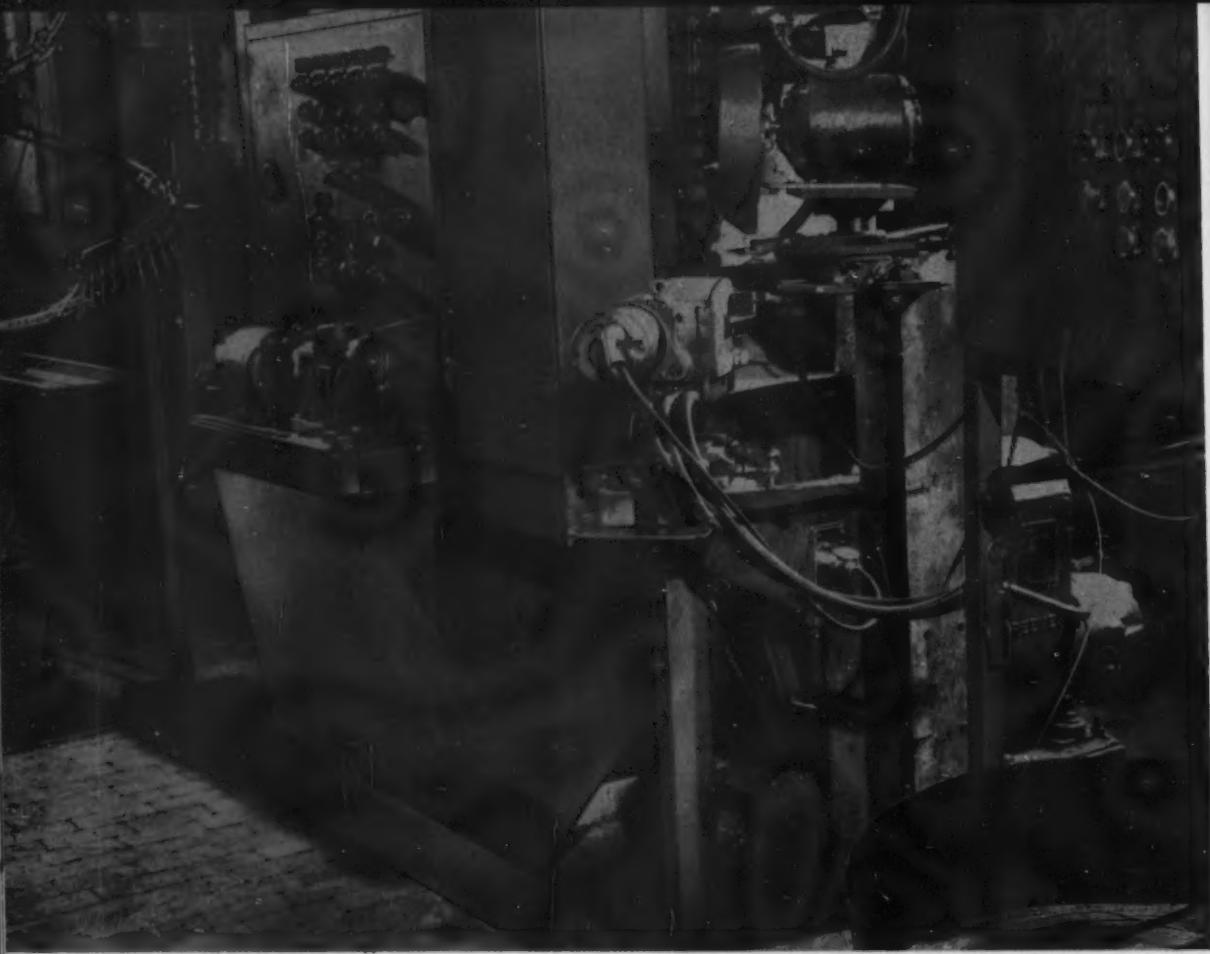


Fig. 7. On this aluminizing machine, the valve faces are wire-brushed and coated with aluminum. The coating is then diffused.

clamping on their stems. Two aluminum-oxide wheels are used—the ends first being ground by a 46-grit wheel, and then by a 150-grit wheel. A surface finish of 30 micro-inches is produced, and the ends are held square with the stem axes within 0.0007 inch, total indicator reading.

After washing to remove the grinding oil, the valve faces are aluminized by metal spraying on Lindberg units such as the one seen in Fig. 7. The valves slide down a chute from an overhead monorail conveyor, and are automatically loaded on a continuous-belt, 164-station work-holding fixture. Location is from the end faces of the feet, and the valves are clamped on their stems.

As the valves are carried downward, while being held in a horizontal plane, they are rotated by power rolls which contact the stems. First, the valve faces are wire-brushed. Then they pass

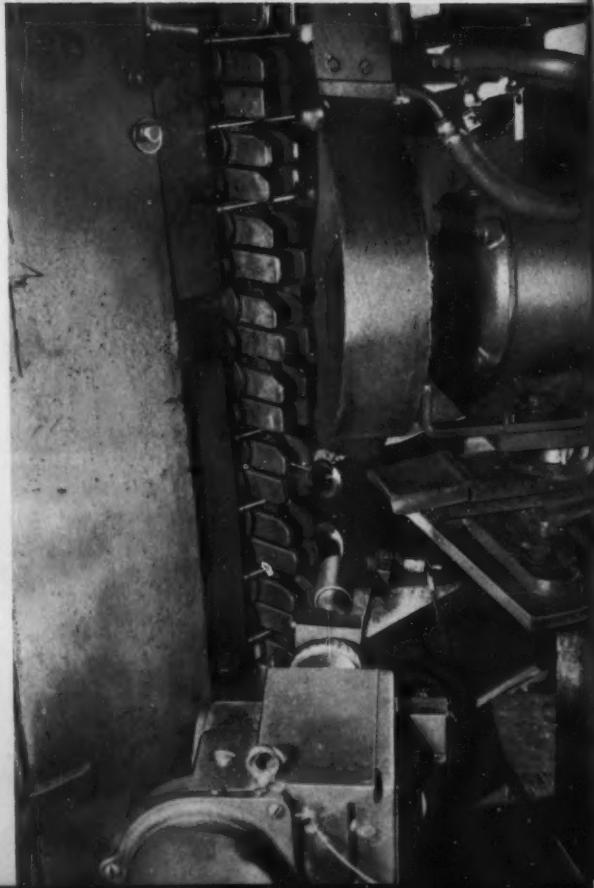


Fig. 8. Close-up view of the metal-spraying station on the machine shown in Fig. 7. The aluminum coating applied is about 0.0007 inch thick.

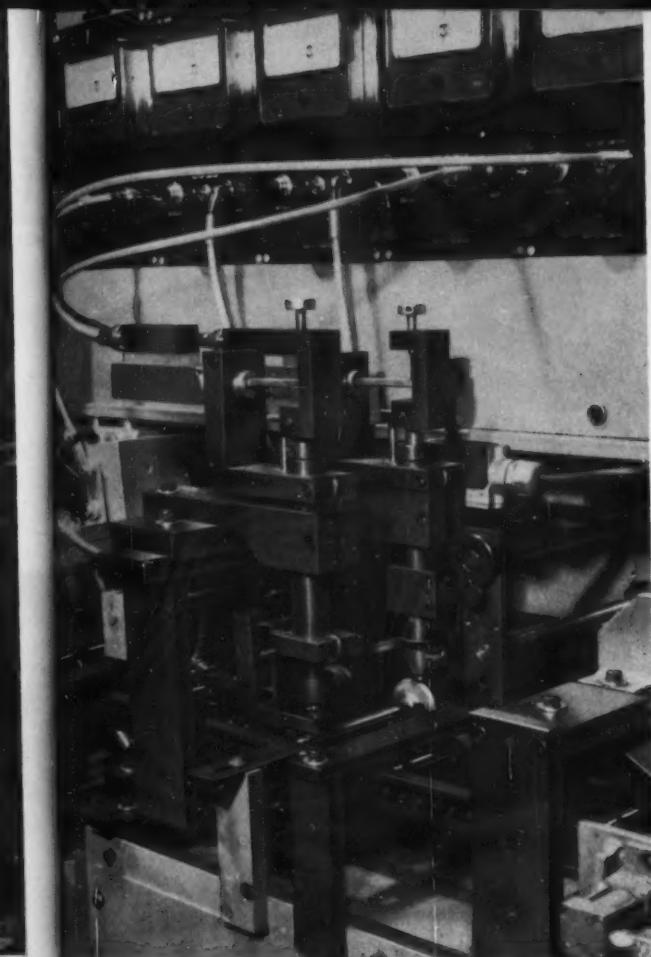


Fig. 9. Electronic gaging machine automatically inspects valves at speeds up to 3000 parts per hour.

through a preheating induction coil, shown at the top in Fig. 8, where the temperature of the faces is raised to 560 degrees F. After again being wire-brushed, the valves move through the aluminizing station, seen at the bottom. Here the seats are sprayed with an aluminum coating from 0.0006 to 0.0008 inch thick.

Wire, 0.057 inch in diameter and containing a minimum of 99 per cent aluminum (Aluminum Association Designation 1100-H14), is supplied to the Metco metallizing gun from 50-pound coils. An oxyacetylene flame and air stream melts, atomizes, and projects the metal onto the rotating valve seats. Diffusion of the sprayed aluminum coating is accomplished by passing the valve faces through a second induction coil which heats them to 1600 degrees F. Then the valves are ejected onto a connecting chute and automatically loaded on a monorail conveyor.

No grinding or lapping of the diffused aluminum coating is performed after aluminizing. In

Fig. 10. Gaging stations on the automatic inspection machine seen in Fig. 9. Parts are transferred by a chain conveyor.



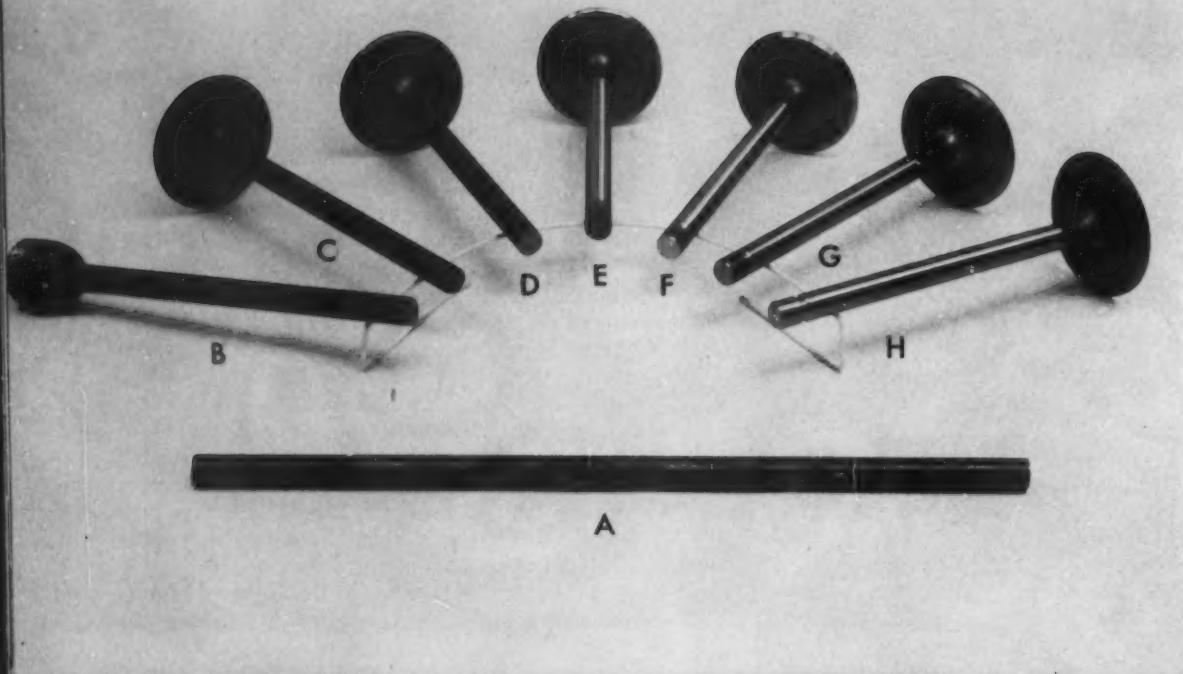


Fig. 11. Major operations performed on intake valves: (A) sheared blank; (B) metal gathered at one end; (C) hot-forged head; (D) machined head and broached foot; (E) ground stem and hardened foot; (F) ground groove, valve face, and foot end; (G) aluminized valve face; and (H) completed valve.

fact, the only subsequent machining required is finish grinding of the valve stems. This is done on Landis centerless grinding machines, with the valves automatically dropping onto the work-rest blades of the machines and being located from the foot end. From 0.0009 to 0.0020 inch of stock is removed with vitrified-bond, aluminum-oxide grinding wheels, 24 inches in diameter, having a 90 grain size. Dressing of the grinding wheel is accomplished with a formed diamond wheel mounted on a rotary, traversing assembly made by the Wheel Trueing Tool Co. Surface finish of the valve stems is maintained between a minimum of 30 and maximum of 80 micro-inches. Also, the stems must be round within 0.0003 inch, must not taper more than 0.00035 inch, and must be straight within 0.0005 inch, total indicator readings.

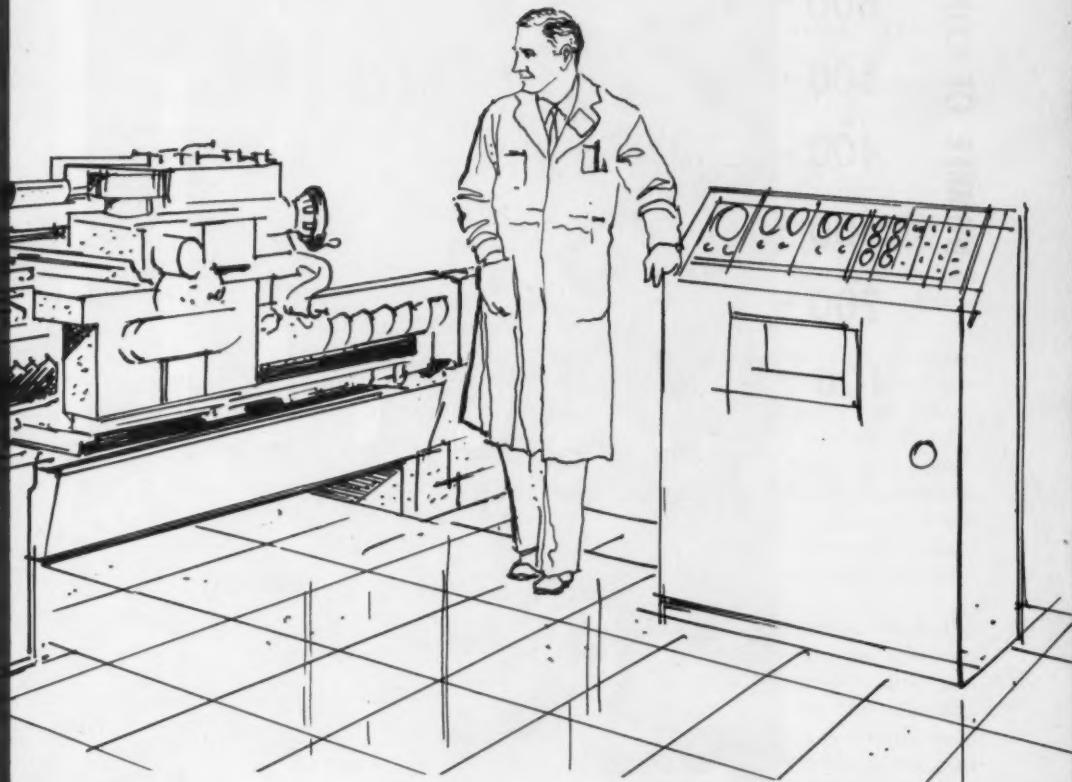
Completed valves are automatically inspected, classified, and sorted on machines such as the RCA unit seen in Fig. 9. Finish-machined valves slide down a connecting chute and are automatically loaded on a gaging block. As they are transferred from station to station by a chain conveyor,

Fig. 10, the valves are electronically checked for stem diameter, stem taper, bow of the stem, groove diameter, head diameter, and concentricity of the valve face to the stem.

A visual inspection is also performed to detect nicks, chatter marks, and any other undesirable irregularities. After acceptable valves have been dipped in oil to protect them from corrosion, they are packed, 200 to a carton, and shipped to the engine assembly plants.

Major operations in the production of a typical intake valve are illustrated in Fig. 11. A blank sheared to the specified length from bar stock is seen at A. At B, an onion-head has been formed on one end of the blank by hot metal gathering. A part with a hot-forged valve head is shown at C. The valve at D has been turned, faced, and chamfered, as well as sheared and broached to length. At E, the valve stem has been rough-ground and the foot induction-hardened. The retainer groove, seat, and end face of the foot have been ground on the valve shown at F. An aluminized valve seat is illustrated at G, and a completed valve, at H.

Numerical contouring gets its second wind

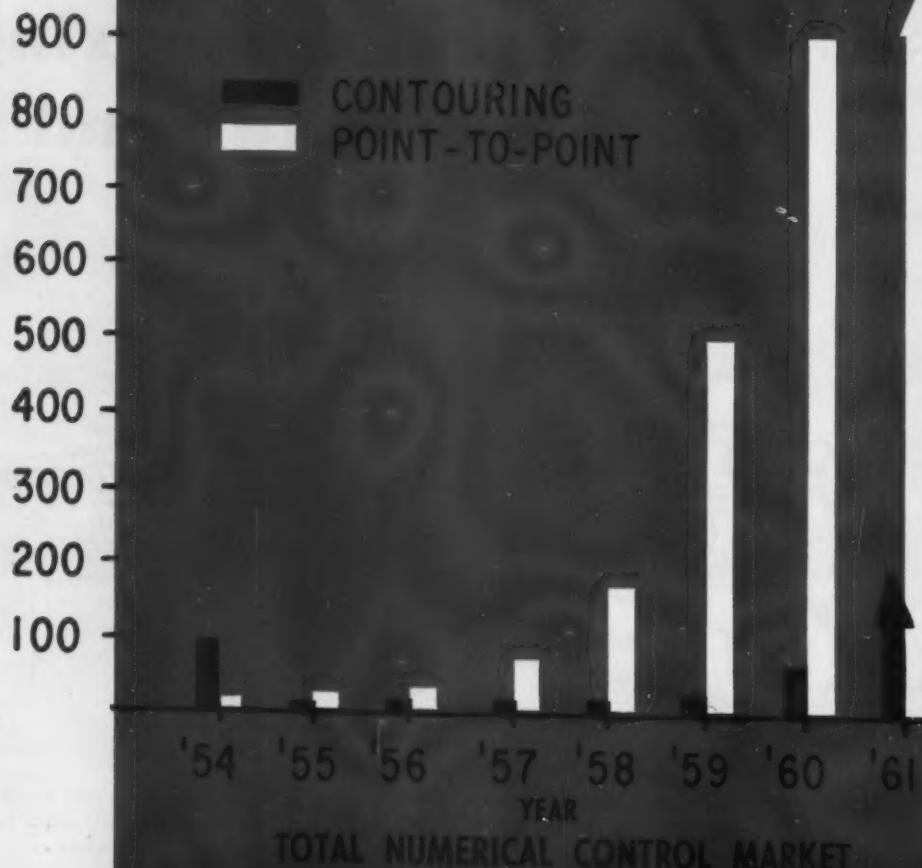


path contouring is now versatile, more accurate, and easier to own than was the case only a few months ago. The new solid-state controls are feasible for the medium and smaller shops, thanks to easier programming

JOHN L. DUTCHER
Metalworking Machinery Engineering
General Electric Co.
Schenectady, N. Y.

DURING the last half of 1960, "second-generation," numerical contouring systems were introduced by several of the leading suppliers of numerical control. These new continuous-path numerical-control systems differ from their predecessors in that they use solid-state circuitry rather than vacuum tubes. They are made up, almost completely, of plug-in circuit modules, and provide such new features as circular interpolation and cutter-radius compensation. In addition, they are lower in price than most of the earlier continuous-path control systems. The result is

NUMBER OF CONTROLS



easier programming, greater reliability, and simpler maintenance at a cost that makes them practical for application to a wide variety of machine tools. A regeneration in the acceptance of numerical contouring is thus beginning to take place.

Numerical contouring got its real start in 1954, when the United States Air Force purchased slightly over 100 skin mills and profile-milling machines equipped with continuous-path numerical control. Although these machines have proved highly successful in various aircraft plants, there were relatively few additional machines built in the following five years. For example, only about twenty machines went into service in 1959.

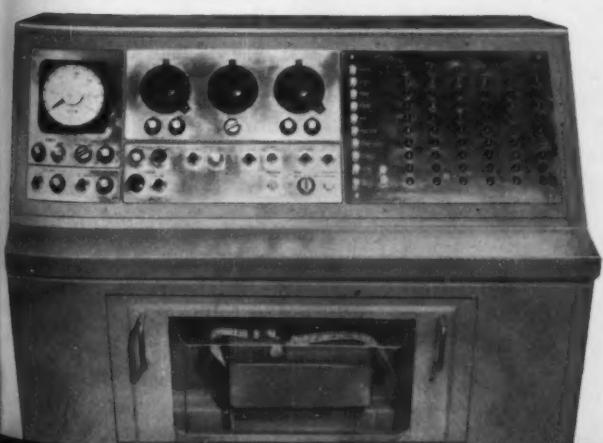
Conversely, purchases of point-to-point numerical-control systems started rather slowly, with no large Government procurement. But buying volume has increased steadily to approximately 500 units in 1959 and about 900 in 1960 (Fig. 1). These point-to-point digital systems were relatively inexpensive and were applicable to small machines as well as large ones. They were relatively easy to integrate into a mechanical manufacturing operation because the programming of the input tape data could be done quite simply.

Continuous-path systems were several times more expensive. Putting them to use required

Fig. 1. (Left, above) Growth comparison chart recording the increases in installations of point-to-point and contouring systems since 1954.

Fig. 2. (Left) Recently introduced Airco flame-cutting machine is a new application for tape contouring with the new control system. Servos on the heads will change the angle of the torches to cut bevels as programmed on the tape. Air Reduction Co. built the machine with General Electric Mark Century controls.

Fig. 3. (Below) Operator's controls are functionally arranged in sequence of normal operation. Tape reader located immediately beneath controls has magnetically latched door.



much more planning, training, and setting up of means to prepare the control tapes. In every case, computers were required to prepare the input data. For reasons of cost and complexity of use, numerical contouring was applied only where a major part of the work involved complex contours that had to be machined to relatively close tolerances. These requirements are found primarily on parts that are profile-milled in the aircraft and missile industries.

This pattern of the "first generation" is already in the process of change, to a very large degree, with the introduction of the second-generation systems. These new systems are being applied to a much broader spectrum of machine tools, including controls to horizontal engine and turret lathes (heading illustration), vertical turret lathes, vertical boring mills, grinding machines, flame cutters (Fig. 2), and drafting machines, as well as expanded use on horizontal and vertical milling machines in production and toolroom categories, including die-sinkers.

Representative of second-generation contouring controls is the General Electric Mark Century. Its contouring system typifies the recent advances that have been made, and shows why continuous-path numerical control is now practical for a broad variety of machine tools, even in the smaller shops. "Mark Century" is a name which applies to a complete numerical-control family. It includes both point-to-point and continuous-path systems.

This description will be concerned with the continuous-path type only. The system provides contouring controls for two-, three-, four-, and five-axis machines. Input data to the machine control is in the form of letters and numbers in binary decimal code, on 1-inch wide perforated tape. The tape reader can be either mechanical or photoelectric, depending upon the reading rate required by the specific application. (A typical control console is shown in Fig. 3.)

Essentially, all of the control is made up of solid-state, transistor and diode computer type circuitry in printed-circuit, plug-in modules, as shown in Figs. 4 and 5. The small amount of analog type circuitry required for the machine drive servos also consists of similar plug-in, printed-circuit boards. All of the digital computing circuitry operates in the binary decimal code. The use of this code makes the system highly flexible, permitting the addition of extra digits or shifting of decimal points. Thus, it can be made equally applicable to the 1-foot travel of a lathe cross-slide or to the 40-foot travel of a large skin or spar milling machine. It can accommodate the few thousandths of an inch per minute feed-rate of a vertical boring mill and also the 500-ipm traverse of a turret lathe.

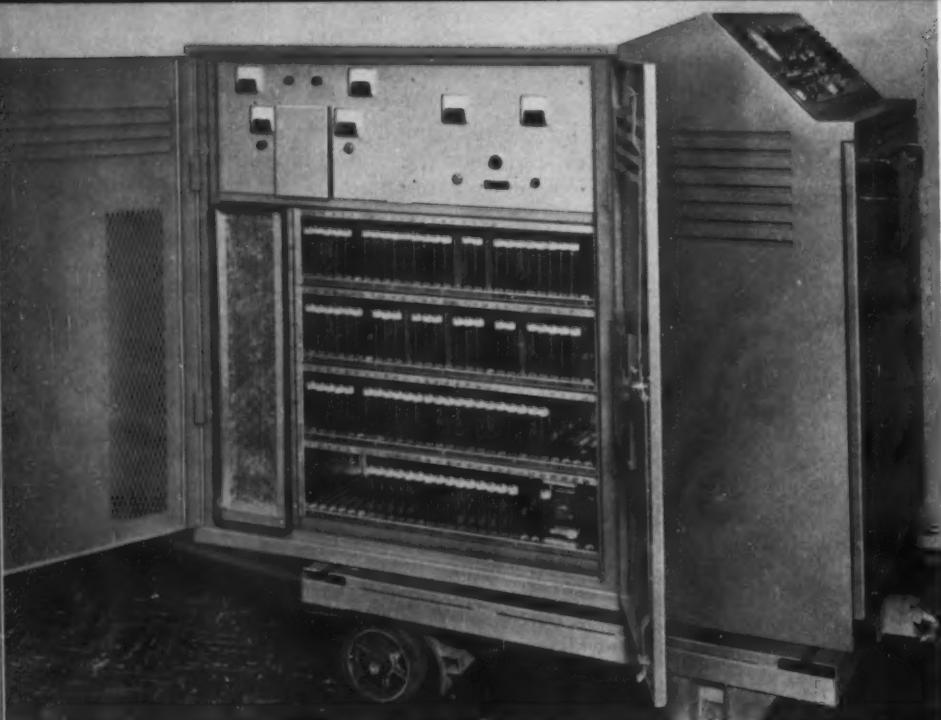


Fig. 4. Interior of control shows logic circuit modules arranged in color-coded racks in compartment isolated from the auxiliary magnetic control and servo-drive controls.

Programming Simplified

The advances in this second-generation control that contribute to simplified programming are: (1) the ability to cut a circular arc from a single block of input data (circular interpolation); (2) the use of binary decimal code on perforated tape, permitting the control tape to be punched on an electric typewriter tape punch; and (3) the use of easily determined commands for distance and feed-rate data.

Such features make it practical, in many cases, to manually compute the input data and manually punch the tape. It should be emphasized, however, that regardless of how simple the part may be, the use of a digital computer for tape preparation offers advantages, especially in saving time. Where the parts are complex, or involve many curved surfaces which are not circular, the use of a computer for data preparation is a practical necessity. However, for simpler work, such as many turned parts, although the use of a computer is advantageous, it is not essential. This is of particular interest to companies which do not yet have easy access to a computing facility for tape programming.

Linear and Circular Interpolation

Most of the first-generation contouring systems had the ability to do linear interpolation only. That is, from a single block of input data they could generate only a straight-line cut. Thus, where any curved surface was required, it was necessary to approximate the curve by a series

of chords, using a block of data computed for each chordal segment. This required extensive computation and many extra blocks of data on the input tape. For example: to approximate 90 degrees of a 3-inch radius arc by a series of chords that do not deviate from the true arc by more than 0.0002 inch requires approximately seventy chords. This requires computing seventy sets of data, and these data occupy about 140 inches of input tape.

The second-generation controls include the regular capability for linear interpolation and they can also do circular interpolation. Any arc of a circle that falls within a single machine quadrant can be represented by a single block of tape data. This data includes five numbers, as will be shown later, and occupies about 3 inches of tape, as compared to 140 inches previously.

In contour-machining, on an over-all average, over 90 per cent of all parts involve nothing but straight-line and circular surfaces. In some particular classes of parts this proportion is even higher. So the advantage of the circular-interpolation capability is readily evident. Circular interpolation is not essential when computer-assisted tape preparation is used because the computer can easily program the straight-line approximations. But in operation the capability is an advantage because the result is a smoother arc and thus a less-wavy surface.

Input Data

The basic input commands, which are to be punched in the tape, are listed as follows:

Preparatory Commands

g01 — straight line
g02 — CW circular arc
g03 — CCW circular arc

The first programming that appears on a block of tape is the preparatory command. This tells the control whether the data that follows is to represent a straight line or a circle and the direction of its curvature.

X±9.9999 - X distance, inches
Y±9.9999 - Y distance, inches
I 9.9999 - X arc center distance
J 9.9999 - Y arc center distance
F 500 - feed-rate number

The distance commands are departure distances; that is, the distance that each axis must move to complete the desired straight line or arc. These are entered as shown with an X or Y address, with a plus or minus sign to signify direction, and the distance (to four decimal places). If straight-line cuts longer than 9.9999 inches are required, they can be handled by two or more blocks of data, or controls can be furnished that will accept distances up to 99.9999 inches.

For a circular arc, additional data are needed. Fig. 6 shows such an arc. The X and Y commands are the same as for a straight line: the total distances that each machine axis must move. Commands I and J are the coordinate distances between the starting point and the center of the arc.

For either a straight line or an arc it is necessary to indicate the required rate of feed (the

speed of the tool along the work-surface). This is entered as a feed-rate number with an F address. If the cut is a straight line, the feed-rate number is equal to ten times the required number of inches per minute, divided by the approximate length of the cut. If the cut is an arc, the feed-rate number is equal to ten times the required tangential speed in inches per minute, divided by the radius of the arc.

Of course, for three-, four-, or five-axis machines additional distance commands are needed for the additional axes. On all machines there are auxiliary commands for starting and stopping the machining operation and for performing other functions which an operator would otherwise control by switches or push buttons.

Cutter-Radius Compensation

The input data described define the path that must be followed by the center of the tool. To obtain these commands it is necessary to start with data defining the required part surface and to compute new data defining the tool center path, which is offset from the desired machined surface by the amount of the tool radius. These are quite complex and time-consuming computations when the machined surface is three-dimensional, such as a die cavity. They are also quite complex for some two-dimensional work.

It is evident that since the tool radius is used in these computations, the tool size must be determined exactly, before the tape is prepared. Once a tool has been sharpened it cannot again be used with that particular tape because its radius

Fig. 5. Plug-in, printed-circuit boards slide into functionally coded racks. Each board and receptacle is pin-coded so that only the proper type of module can be inserted.



is different. Because of these problems, a new control function has been made available with the second-generation controls. This is tool-radius compensation. It is offered as an optional modification to the standard controls, and while it is a fairly expensive extra, it offers many advantages for certain types of work. In the Mark Century control this modification is available as full tool-radius compensation, making it possible for use as tape input data, information defining the desired machined surface rather than the tool center path. The machine operator then manually enters the actual tool radius to be used on a set of decimal dials on the control console, and the machine control automatically computes the required tool offset.

As an alternative method, the tape data may be entered using a tool center path as before. The operator then enters the correction between the tool radius used to compute this tool center path and the actual tool radius being used. Tool compensation is operable only in two dimensions as presently available, and cannot yet handle three-dimensional tool offsets. Cutter-radius compensation, when included in a specific control, considerably simplifies data preparation for two-dimensional parts and allows the use of reground tools without preparing a new tape.

cur, and getting the machine back into production in a minimum of time. One of these features is the use of plug-in circuit modules throughout the system. A three-axis control requires a total of about 200 printed-circuit board modules. In this group of 200 there are about twenty-two different types. Thus a stock of twenty-two spare boards is sufficient to make replacements immediately available.

Where several controls are installed in one plant, one slightly larger set of replacements will suffice for all of them. In addition, since many board types are interchangeable between the continuous-path and point-to-point controls in the Mark Century line, the replacement problem is further simplified.

A given plug-in module may contain thirty to fifty individual circuit components. Yet the complete module may be treated as a unit in diagnosing and correcting malfunction. Thus the maintenance man has far fewer components to think about.

In order to further simplify maintenance, considerable checking circuitry is built into the control. This circuitry is used in conjunction with a maintenance test tape for preventive maintenance and trouble shooting. The test tape sequentially exercises each section of the control, a program taking three or four minutes. The test cycle stops and a test light goes out if the control fails to perform correctly at any point. By checking the block of tape in which the failure occurred, the maintenance man can determine, from a table in the instruction book, the faulty section of the control. This localizes the source of trouble to a group of six or eight plug-in modules—a small percentage of the 200 used.

The instruction book informs him of the decimal number that should, at this point, be stored in each of these few boards. He then plugs condition indicators (the small test board shown in Fig. 7) into the front of each suspected board and, with these, he can read on four small neon lights the number that actually exists. The board that has failed will show a wrong number, and thus he can pinpoint which one to replace. Faulty boards can be returned to the factory for replacement, or they can be repaired on the bench by the maintenance man, separate from the control. A printed-circuit board tester and analyzer is available which speeds repairs.

The purpose of any trouble-shooting procedure is, of course, to get the machine back in operation quickly. The factors that speed up the procedure are the use of small plug-in modules; the inclusion of checking circuitry in the control; the use of decimal computing for simple read-out of stored data; and, of course, the test tape. This procedure cannot diagnose all possible failures

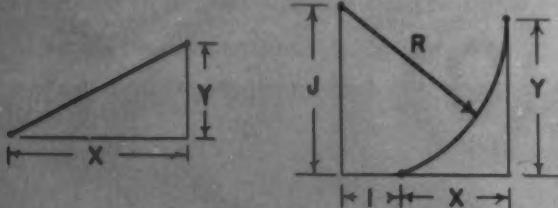


Fig. 6. Additional data is needed for programming a circular arc. Parameters (I) and (J) are coordinate distances between the starting point and the center of the arc.

Maintenance Simplified

Many of the design and construction features of these control systems are dictated by the need for quickly diagnosing any trouble that may occur,

HOW THE CONTROL WORKS

Machine position is measured by rotary resolvers driven either from the machine's precision ball screws or from special precision racks on each machine slide. Where higher accuracy on medium-size machines is required, a special linear measuring device, called Accupin, may be used. The machine drives may be direct-current servo motors or hydraulic motors or, in occasional cases, linear hydraulic cylinders. Illustrated is a simplified block diagram of one of the new three-axis numerical-contouring controls. The blocks at the lower right marked "X axis" are those parts of the control associated only with that machine axis. In an actual control system there is a similar section of control for each of the machine axes. The remaining blocks shown are used in common by all machine axes.

A clock oscillator supplies a high-frequency stream of pulses to the control circuitry. The sine-cosine generator converts these pulses into 250-cycle, 2-phase voltages for exciting the position feedback resolvers. These resolvers are small rotary devices whose output is a 250-cycle alternating-current voltage, the phase angle of which varies with their angular position.

A resolver is geared to each machine feed so that it makes one revolution for each 0.1 inch of machine movement. The phase of its output voltage then varies through 360 electrical degrees for each 0.1 inch of machine movement. Thus the resolver output is an indication of machine position.

The command phase counter generates another 250-cycle voltage and causes its phase to vary as the machine is required to move. This voltage is compared with that from the resolver in the phase discriminator, and the discriminator output works through the servo amplifier to move the machine to keep these two voltages synchronized. The machine element is thus caused to move as desired.

The clock-oscillator pulses are also fed through the manual feed-rate override control. When the operator adjusts this control, he varies the rate of pulses that are allowed to pass through it, and this varies the machine feed rate from that called for on the tape. If this control is set on 100 per cent, the machine moves at the rate programmed on the tape. At any other setting it operates at a given percentage of the programmed rate, from 0 to 150 per cent.

The rate of pulses out of the feed-rate override control is further modified by the feed-rate command counter. This reduces the pulse rate further in proportion to the feed rate that is programmed on the tape. Thus the rate of pulses going into the arc and slope function generator is proportional to the feed rate that was programmed on the tape, modified by the operator's setting of the override control. It is thus proportional to the desired feed rate along the work-surface.

The function generator breaks down this pulse rate into a separate stream of pulses for each machine axis. A pulse is generated for each axis every time the particular axis should move 0.0001 inch. When the machine movement is continuous, as it usually is, this becomes a rapid stream of pulses for each axis.

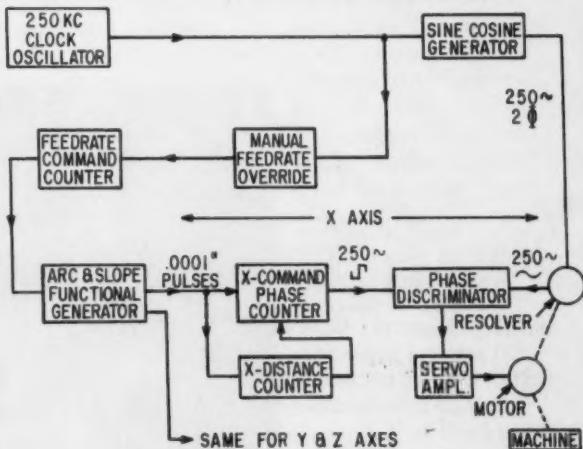
When the particular cut is a straight line, the pulses for each axis are received at uniform rates proportional to the cosine of the angle between the desired path and the particular machine axis.

If the cut is to follow an arc of a circle, the function generator, in effect, computes a new angle for each 0.0001 inch of machine movement. This function generator is a digital computer which computes accurate slopes and smooth arcs.

The output pulses are fed to the control for the respective machine axes. They go to the command phase counters which generate the 250-cycle output command voltages previously described and cause the phase of these voltages to change the equivalent of 0.0001 inch each time an input pulse is received.

These pulses also go to distance counters, where they are totaled; and the cut is terminated when the desired number of pulses has been received.

The feed-rate counter, function generator, and distance counters each receive numerical information from the tape which determines their action for each segment of cut. This numerical information is read from the tape into storage during the previous segment. Thus it can be instantly dumped into the working part of the control when needed, so that there is no hesitation in the tool movement between segments of tool path.



Simplified block diagram of new contouring control shows how versatility, speed, and accuracy are enhanced in the machine tool's operation. Blocks at lower right marked "X axis" are associated with that axis only. For a complete description see "How the Control Works."

that could occur in use, but it does check the major portion of the control system.

Reliability

The second-generation systems take full advantage of recent developments in solid-state circuitry, and are designed and built on a foundation of nearly a decade of experience with numerical control. In the past eight years there have been more than fifty different numerical-control systems developed and marketed. These have used a wide variety of techniques. In addition, users of these control systems have contributed greatly to their builders' knowledge of system and construction requirements.

The type of electric circuitry needed for machine controls is considerably different from that normally found on a factory floor. Consequently, in the Mark Century control an air-conditioning system automatically maintains optimum temperature and humidity inside the control enclosure. The air conditioner makes use of an air-to-air heat exchanger, so that the control cabinet can be completely enclosed. The cooling air passes through the air conditioner only, and thus no outside air is introduced into the cabinet.

Cost

The factor that is probably contributing as much as any to the acceptance of second-generation contouring controls is their reduced cost as

compared with older systems in the same general category. Two years ago a punched-tape contouring system for an engine lathe might have cost three to four times as much as a point-to-point control for the same machine. Thus, several point-to-point systems were adapted to lathes although they were generally limited to straight cuts in line with the machine axes. Today the contouring control for this same lathe is not more than twice as expensive as a comparable point-to-point system, and offers the added capability of cutting tapers, fillets, or other curved surfaces, and even threads. Thus, when the added cost of contouring for this type of application is considered as a percentage of the total machine cost, it can usually be justified. Tape-controlled horizontal boring, drilling, and milling machines and other millers are additional cases where a similar condition exists.

Numerical contouring got off to a fast and successful start in the aircraft industry, but demand leveled in what appeared to be a saturated market. However, the second generation of contouring controls is so versatile and easy to program that it has already assumed a position of major importance in the whole metal-cutting field. Capital and operating costs are greatly reduced. Point-to-point systems will continue to predominate in number of operating units. But contouring systems will make up a much larger percentage of the total than was anticipated only a short time ago.

Fig. 7. Condition indicators plug into the front of data storage modules for troubleshooting check. The units indicate numerical data stored or processed on the boards.





DELMAR W. KARGER

Head, Department of Management Engineering
Rensselaer Polytechnic Institute
Troy, N. Y.

THINKING WITH MANAGEMENT

Foreign Sources Offer New-Product Ideas

AMERICAN COMPANIES in virtually every industry classification are seeking new products to make themselves. Every one of these firms would like to eliminate the time and costs associated with the necessary new-product research and development. Rather surprisingly, many companies are finding that it is possible to do away with most of the time element and much of the research cost by acquiring rights to make and sell foreign-developed products in the United States.

Many European products can be successfully made and sold in the American market. Some are immediately producible in the United States; some will be found that can be manufactured in this country if certain redesigns are incorporated to lower the direct labor-cost content. Others will be found which are being sold on a limited basis in the United States through traditional import channels. But they may have failed because the number of steps in the distribution channel has caused the price to be out of reach of the American buyer. Other products can be found in Europe which could be made and sold here if engineering and manufacturing responsibility were centered in an American rather than a European concern, which is too remote from the buyer. Finally, some European products can be successfully sold in the United States if they have removed from them the handicap of being foreign products manufactured abroad. We still buy American.

There are several basic approaches that can be explored as feasible means of association with a European company. While many variations of these are possible, the more basic and main approach are as follows:

1. License to manufacture the product under a royalty arrangement.

2. Negotiate a cross-licensing arrangement where manufacturing rights on United States products are exchanged with the foreign company.

3. Establish a technological exchange program.

4. Buy the rights to produce in this country.

5. Form a subsidiary to produce the product in the United States, giving the European company an equity position in the new subsidiary, in exchange for the rights to produce the product.

6. Allow the European company to purchase limited equity in the American firm.

7. Purchase the European company.

8. Copy the product if there are no patents or "know-how" problems.

The American seeking new-product opportunities abroad has certain advantages and need not go with his hat in hand, begging. He can be sure that Europeans greatly respect and generally recognize that Americans are second to none in the fields of product planning and development, commercial research (particularly in the industrial market), sales development, application engineering, mass production, physical distribution, and especially in selling to mass markets.

On the other hand, the American is often viewed with suspicion. Thus he is almost sure to fail if he "looks down" upon his foreign brothers. He needs to understand that those he approaches may view him guardedly in the initial phases. He also must resign himself to the fact that the Europeans usually ask for an unreasonably high royalty for the simple reason that the granting of a license in Europe by a European company is often the equivalent to the granting of a monopoly. The reason for this is that one strong producer of a product is all that the local market can support.

How do you go about finding European-developed products that you can make and sell? One of the best methods is to attend the major trade fairs in Europe. This method of merchandising is highly developed abroad, and each of the major fairs is much larger than any comparable effort or show in the United States. In addition, local trade and industry associations are a valuable source.

Precision Indexing of Disposable Inserts

When Is It Justified? What Factors Affect It?

RICHARD D. ZIMMERMAN
Carbide Application Engineer
Metallurgical Products Department
General Electric Co., Detroit, Mich.

PARADOXICAL as it may seem, the ability to index disposable carbide inserts with a high degree of accuracy is usually only needed in the "medium" precision machining range. It is not effective in high-precision work, and it is not needed where tolerances are not close. This principle holds true whether the operation is roughing or finishing. For the purposes of this article "indexability" will be defined as the measured accuracy with which an insert can be changed to present a new cutting edge, the accuracy usually being related to a work-piece dimension.

What constitutes medium precision varies from job to job. However, where precision-ground inserts are in use on work in which tolerances are much less or much greater than 0.012 inch on the diameter, a close look at the operation is in order. It may be that lower-cost, utility-ground inserts will do the job just as well, since adjustment of the tool-slide may be necessary even when precision inserts are used.

This is particularly true if machining is set up by Hi-E (High Efficiency Machining) principles. Through Hi-E, a greater number of inserts are used, but economy is gained by speeding the machine to produce more in a given time.

The reason for the apparent paradox is simple. So many factors other than the insert affect machining accuracy that precision indexability is of no help in working to very close tolerances. Each time an insert is changed, or rotated to a new position, adjustments are necessary if close work tolerances are to be held.

To approach the problem from another direction, if work tolerances are close enough to necessitate adjustment every time the insert is indexed or require it as the insert wears, precision-ground inserts are an unwarranted expense. The use of utility-ground inserts will save money. Also, if work tolerances are very wide, they will not be sufficiently affected by insert precision to make it worth while.

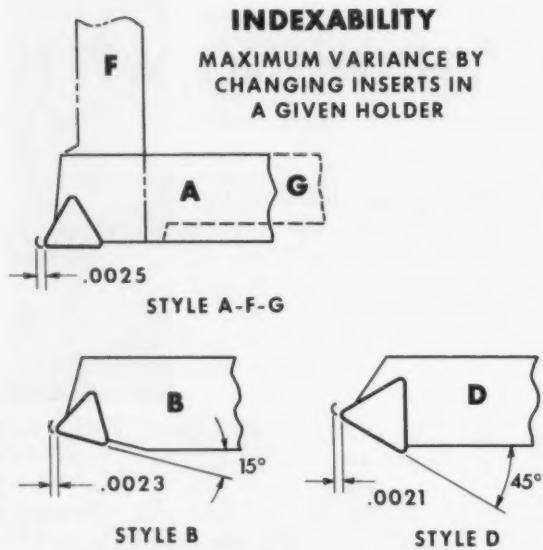


Fig. 1. Differences in lead angle in tool-holder styles can affect precision of indexing. Effect of insert variations when the insert is used in tool-holder styles (A), (F), and (G) will be greater than that of those when the insert is used in styles (B) and (D).

One exception must be noted. Where it is necessary to rough-machine to a minimum size on account of subsequent operations, precision-ground inserts may be desirable to avoid cutting below this minimum.

Included among the factors which affect indexability are those inherent to the insert itself as well as those which are independent of the insert. Independent factors will be considered first.

Tool-Holders

All metalworking has to be done to tolerances that are practical within the limits of the technology and the economics of the situation. This is true no matter what is produced. Tolerances must be allowed in the manufacture of tool-holders, and some of these affect indexing precision.

Certain inescapable geometric relationships also affect indexability accuracy. For example, the pocket in many tool-holders will permit a slight variation in clamping the insert, which is a factor against precision indexing.

Worn or damaged tool-holders can easily nullify precision of the insert. If the pocket is worn so that it is too large, or is distorted in any way, the insert position may change enough in indexing to make a substantial difference.

Variation in side cutting-edge, or lead, angle due to differences in tool-holder styles can also affect precision of indexing. For example, holder style A (Fig. 1) with zero angle will show more of an effect from insert error than will style D. The difference is slight, but when accumulated with other errors it can be significant.

The pocket for a triangular insert is fabricated to 60 plus 0 minus 1 degrees included angle; and that for a square insert, to 90 plus 0 minus 1 degrees. This tolerance has proved most advantageous in limiting insert shift. When the pocket tolerance is minus 1 degree, there is less effect on indexability precision than when the allowance is plus 1 degree.

The reason for this is shown in Fig. 2. When the angle of the pocket is 1 degree larger than nominal, as seen at the left in the illustration, the insert can pivot on the rear corner. This permits more movement of the cutting tip than when the pocket is 1 degree smaller than the nominal size (Fig. 2, right). In the latter case, any shifting of the insert will cause a fishtail motion at the rear. Pivoting will occur about a point near the center of the insert. This results in a minimum change in the position of the cutting tip. The effect of movement in the pocket is greater when tool-holder styles with smaller side cutting-edge angles are used.

Thermal Expansion

Tool-shank steels and tungsten-carbide inserts expand with heat. A typical straight tungsten-carbide grade has a coefficient of 2.66×10^{-6} inch per inch per degree F. Operating temperatures of 750 degrees F. are not unusual if coolant is not used. If the altitude of a selected triangular insert measures 0.719 inch at room temperature, the expansion due to the temperature rise of the insert would be calculated as follows:

$$\begin{aligned} \text{Temperature rise} &= 750 - 72 \quad (\text{room temperature}) \\ &= 678 \text{ degrees F.} \end{aligned}$$

$$\begin{aligned} \text{Linear expansion of insert} &= 2.66 \times 10^{-6} \times 678 \times 0.719 \\ &= 0.0013 \text{ inches} \end{aligned}$$

If the insert were in a lathe tool-holder with a 30-degree side cutting-edge angle, the work-piece diameter would be reduced 0.0026 inch from the time the cut is initiated to the time when the temperature of the insert reaches 750 degrees F.

Tool-holders are made of steel, which has a coefficient of linear expansion about twice that of tungsten carbide. The effect of tool-holder expansion on part size is only from that portion of the tool-holder between the insert and the first

clamping bolt. Temperature rise in tool-holders is seldom as great as that in inserts. However, thermal expansion of the tool-holder can contribute substantially to size change in the work-piece.

Machine rigidity or lack of it is a factor difficult to evaluate and more difficult to predict. There is some flexibility in any mechanical system. Insert, tool-holder, tool-block, work-piece, and the machine all have some "give," and thus contribute to system flexibility.

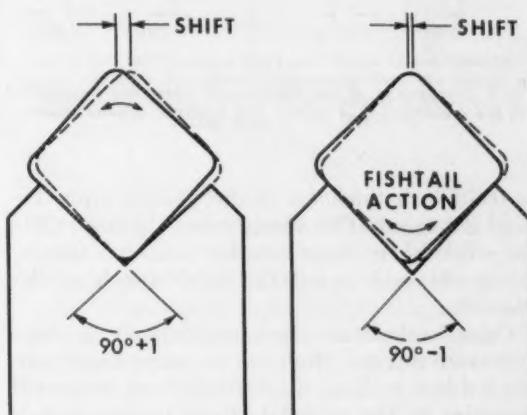


Fig. 2. The included angles of tool-holder pockets are held to within plus 0 minus 1 degree in order to limit the effect of pocket tolerance on precision of insert indexing.

When a tool is moved into a cut, checked, and adjusted, this flexibility is compensated, and no change would occur were it not for tool wear. But as the tool wears, cutting pressure is increased. If the work-piece happens to be a thin shaft, it may deflect away from the tool, reducing the cut and increasing the diameter. The ultimate result may or may not be important, depending on system rigidity and tolerance requirements. However, it is a factor entirely unaffected by insert precision.

Dirt and Chips

Perhaps the most important condition affecting indexability precision has little to do with the quality of the holder or insert. Dirt and chips are always present in machining operations, and they get under the inserts during indexing. Trouble from this source is in proportion to the difficulty of cleaning the tool-holder pocket and in inverse proportion to the care exercised by the machine operator.

The operator may think he is cleaning the pocket carefully, but it is easy to leave a 0.001-

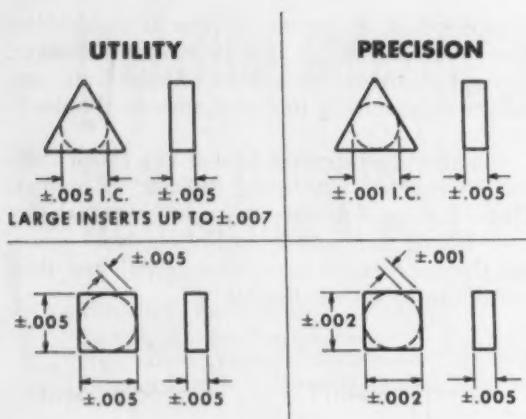


Fig. 3. Comparison of the dimensional tolerances maintained in the manufacture of utility- and precision-ground inserts.

or 0.002-inch thickness of dirt and/or chips behind the insert. This would move the insert into the work by the same amount, and on a turning job would result in a 0.002- to 0.004-inch smaller diameter.

Complex holders which are difficult to clean aggravate this condition. On the other hand, simple holders such as the Carb-O-Lock type will minimize it. The pocket in these holders is easy to see and clean, and has no difficult corners. Moreover, the insert is seated by cam action rather than by finger pressure. This feature promotes greater accuracy in seating.

Insert Tolerances

Inserts have to be manufactured to tolerances, and the tolerance selected must be economically feasible. Costs increase rapidly as tolerances are reduced. As a result, manufacturers generally hold insert tolerances as close as possible without bringing costs to a prohibitive level.

The dimension and tolerance of a triangular insert is catalogued by the inscribed circle—that is, a circle just large enough to intersect each side. A square insert is catalogued by the measurement and tolerance between the sides. These are the most practical of several measurements because, due to insert geometry, no other measurements can come as close to the kind of description the user wants. The catalogue inscribed-circle tolerances are not meant to reflect insert indexability, since other insert dimensional tolerances play an important role in final accuracy.

Inscribed-Circle Tolerances

An ideal triangular insert is a perfect equilateral triangle with nose radii at the angle

apexes. The inscribed-circle measurement (Fig. 3) does not show whether the triangle is perfectly equilateral, since a circle can be inscribed in any triangle.

Similarly, angularity is a factor in indexability. A diamond-shaped parallelogram with equal sides will also have equal dimensions between pairs of sides. Well-made inserts will be very good geometrically, but slight variations are inevitable.

In forming the nose radius on an insert, the object is to obtain a uniform radius, precisely tangent to the insert sides and precisely located (Fig. 4, top view). Some error can occur due to lack of symmetry. As shown in Fig. 4, center view, the radius can be too far out, or too far in, by a small amount. It can also be displaced to the right or left. On inserts which must be ground, it is difficult to relate the radius to a specific dimension with a high degree of precision.

Insert and seat thickness is not a large source of indexing error because its effect is an angular resultant. Usual insert and seat thickness tolerances are plus or minus 0.005 inch and plus 0.000 minus 0.005 inch, respectively. Generally, seat thickness can be disregarded, as the seat is changed only a few times during the life of a tool-holder.

What happens when an insert on the low side of the tolerance is replaced with one on the high side is illustrated in Fig. 5. If the height of the top of the insert is increased by 0.010 inch, the

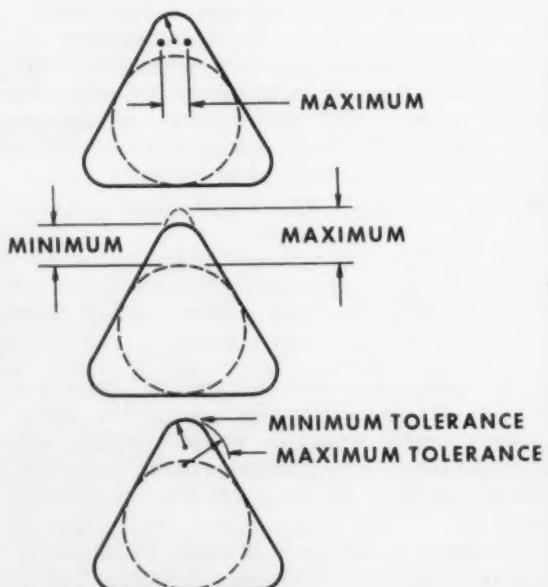


Fig. 4. Some variation can occur in the forming of insert nose radii. They may be displaced inward or outward, or to the left or right, of the precise tangent position.

effective infeed of the insert to the work-pieces is increased by 0.001 inch with a 6-degree negative-rake tool cutting on center. If a positive-rake tool insert is changed from thinnest to thickest, the depth of cut is reduced as shown.

The effective inscribed-circle dimension of a positive-rake insert may be smaller than indicated. This is due to the tolerance on the 11-degree (average) relief angle. Since the insert is high in a holder pocket, contact with the pocket occurs below the top of the insert (Fig. 6).

Measured Variations in Inserts

To measure the effect of the variations solely due to the insert, groups of inserts from several manufacturers were checked for accuracy.

Utility-Ground Inserts

	Indexing Accuracy Range
Lot A	± 0.0085 inch
Lot B	± 0.0045 "
Lot C	± 0.0037 "
Lot D	± 0.0041 "

Precision-Ground Inserts

	Indexing Accuracy Range
Lot A	± 0.0021 inch
Lot B	± 0.0021 "
Lot C	± 0.0012 "
Lot D	± 0.0008 "

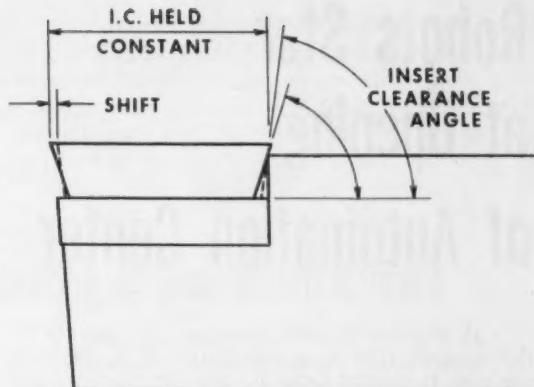


Fig. 6. The tolerance on the relief angle of positive-rake inserts can vary the effective inscribed-circle dimension, since contact with the holder pocket is made at a point below the top edge of the insert.

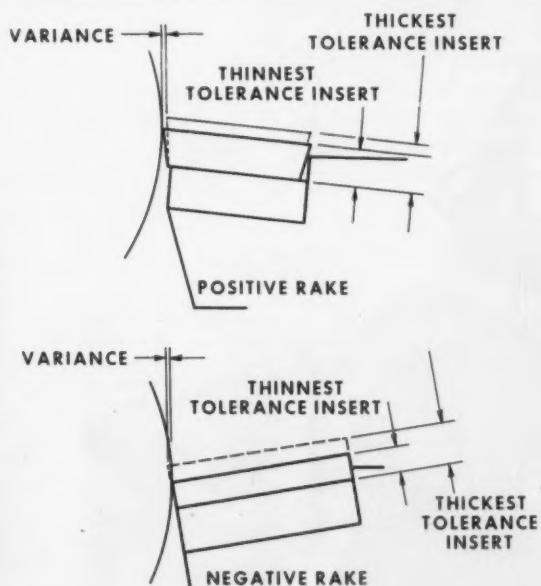


Fig. 5. The maximum effect of insert thickness tolerance on part size. When the thinnest insert within tolerance is replaced by the thickest, the depth of cut of positive-rake tools is reduced, whereas that of negative-rake tools is increased.

The data is for changing inserts and indexing corners of inserts within a single tool-holder. As is to be expected, all these inserts show some variation. None of these indexability variations include normal tool-holder variations that may add to or subtract from the result. Nor is the effect of cumulative errors indicated. If these are all plus, or all minus, the total variation can be substantial.

The major factors affecting machined size tend to increase with cutting time, and their total result is usually cumulative. A "human" factor exists which covers things like failure to clean the seat properly when indexing and variations in seating the insert. Some factors such as insert tolerances are constant during the cut, but edge wear and cutting forces increase with machining time.

Conclusion

Indexability of mechanically held inserts is the complex resultant of many factors. Insert variations are only one of the several important factors. It is felt that precision ground inserts are often specified where not needed. A study of individual jobs will certainly yield economies where conversion from precision to utility ground inserts is indicated.

CORRECTION

In addition to the 1961 graduates listed in the September issue of MACHINERY, pages 131 and 132, as winners of MACHINERY's Achievement Award for outstanding excellence in machine design, the name of Larry E. Cole, who graduated from Tulane University, should be included.

Robots Star at Opening of Automation Center

A production facility designed exclusively for the manufacture of automation equipment was officially launched when John I. Snyder, Jr., president and chairman of U. S. Industries, Inc., cut the tape at the dedication of the USI Robodyne Division's new Automation Center. Under roof are 57,000 square feet of manufacturing, engineering, and administrative area in Montgomery Industrial Park, Silver Spring, Md.—eight miles northeast of Washington, D. C.

This new facility is the home of the TransfeRobot 200, vibratory feeders, and other automation accessories; the DigiFlex automated training machine; and the new MemoTutor teaching machine.

Unusual in the scope of its application, the TransfeRobot 200, Fig. 1 and right in Fig. 2,

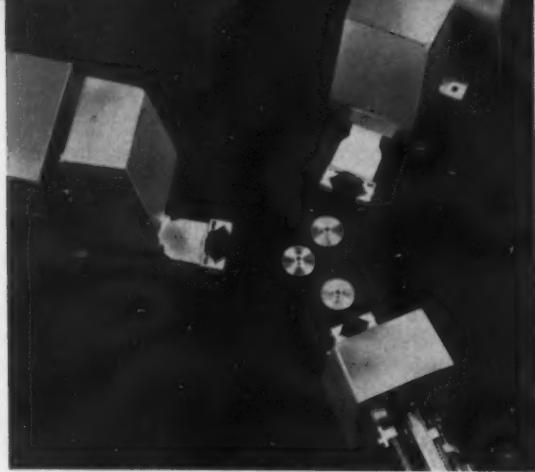
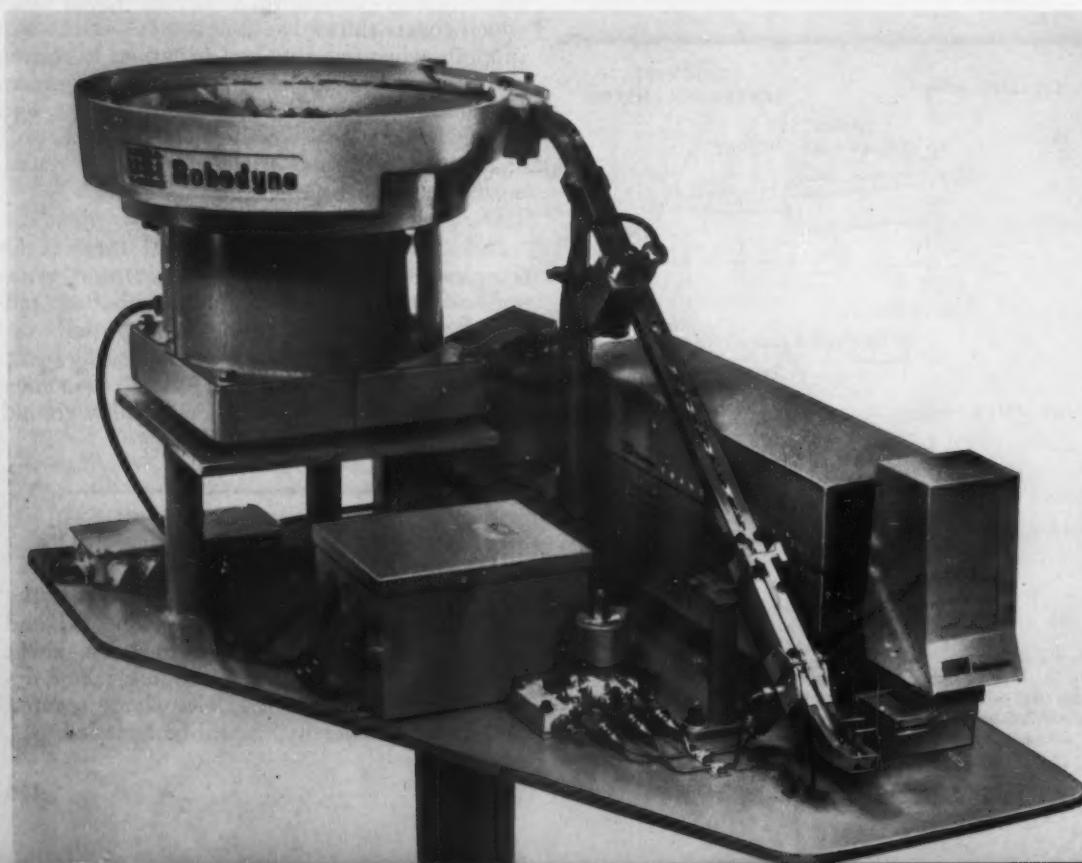


Fig. 1. Three mechanical hands reach out to grasp three small gears in a symbolic demonstration of the capabilities of the TransfeRobot 200. The hands, or jaws—which can seize, move, turn, and position any small part—are interchangeable with other jaw extensions.

contains its own electronic brain and is claimed to be the first low-priced (\$2500), flexible automated machine to be manufactured in quantity for use on any production line. The device is suited to handling and assembling virtually all small components. It usually works in conjunction with U.S.I. Robodyne segmented vibratory feeder bowls, left, Fig. 2. Through its electronic brain, the TR 200 takes directions from, and gives directions to, other TR 200's working in line, in

Fig. 2. Segmented vibratory feeding bowl, left, supplies small components to the waiting jaws of an automated robot, right. The bowl is constructed so that one small piece may be replaced to accommodate a totally different part.



addition to any cooperating machines. In half an hour it can be taken off one job and reprogrammed for another simply by changing its grasping parts and providing new instructions.

Engineers at the Automation Center are designing an entire family of robot machines suited

to a wide variety of tasks. Since the TR 200 went into production last June, more than fifty have been purchased for use on assembly lines. Indications point, the division feels, to a probable annual market of \$100,000,000 for such devices within five years.

Technical Sessions Feature Meeting of Gear Manufacturers

An exceptional number of technical papers which emphasized the modern equipment available today for cutting and forming gear teeth were presented at the semiannual meeting of the American Gear Manufacturers Association. The meeting was held at the Edgewater Beach Hotel, Chicago, Ill., from October 29 to November 1, inclusive.

The following papers were presented on the morning of October 30: *Hobbing*, W. P. Kahn, Fellows Gear Shaper Co.; *Hobbing Equipment and Techniques*, Richard Hildreth, Michigan Tool Co.; *Heavy-Duty, Coarse-Pitch Hobbing with Automatic Cycling*, R. W. Erickson and D. E. Brown, Barber-Colman Co.; *Large Gear Hobbers and 10HQ HOBLIQUE*, Jerome E. Hequembourg, Gould & Eberhardt Division, Norton Co.; *Michigan-Lorenz Gear Shapers*, Richard Hildreth, Michigan Tool Co.; *Michigan Shear-Speed Gear Shapers*, Richard Hildreth, Michigan Tool Co.; *The Shaping Method for Generating Gear Teeth*, J. L. Williamson, Fellows Gear Shaper Co. Russell C. Ball, Jr., president of the Philadelphia Gear Corporation, presided during the presentation of these papers.

On the afternoon of the next day, the following papers were read: *Chipless Production of Toothing Forms by Roll Forming*, Willard B. Mc-

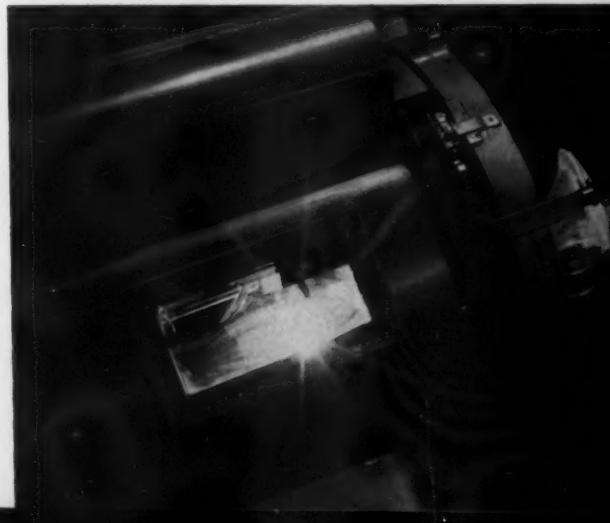
Cardell, Michigan Tool Co.; *Cold Forming of Internal Profiles on the Fellows-Appel Cold Forming Machine*, E. Tlaker, Fellows Gear Shaper Co.; *An Outline of Equipment and Methods for Manufacturing HRH Gears and Pinions*, Harry J. Hart, Gleason Works; *The Gleason Helixform Process and the New No. 607 Helixform Machine*, R. A. Hollinger, Gleason Works; *Producing Gears by the Broaching Process*, Joseph A. Psenka, National Broach & Machine Co.; *ZERATE Gears*, M. L. Baxter, Gleason Works. F. A. Smyth, president, Alling-Lander Co., Inc., was in charge of this meeting.

Two additional papers of merit presented at other sessions were: *Calculating Conjugate Helical Forms*, by William C. Smith, project engineer, Barber-Colman Co.; and *Modified Pinions, Fine Pitch Spur*, by Richard L. Thoen, staff engineer, General Mills, Inc.

In addition to these sessions, the various technical committees held their customary meetings.

Another feature of the affair was a highly inspirational address given at the opening session by Dr. Kenneth McFarland of the General Motors Corporation. It was entitled "Living to the Point." Robert Sheridan, president, Nationwide Leasing Corporation, gave a talk on "When and How to Use Leasing in Modernizing Your Plant."

Welding of columbium is observed through window of controlled-atmosphere chamber at Dresser Products, Inc., Great Barrington, Mass. In existence since 1955, the organization specializes both in fabricating nuclear reactor core components and in research in the field of reactor control materials. Dresser is a major producer of rare-earth metals in rod, wire, tubing, plate, and sheet forms. Intensified efforts are being made to develop joining methods for refractory alloys and metalworking procedures for a variety of high-temperature materials.





LAURENCE W. COLLINS, Jr.
Associate Editor

New Point-to-Point Drill's Cost Pulled Down by Own Bootstraps

WITHOUT the cost savings inherent in the Pratt & Whitney Tape-O-Matic drill, production units could not be built at a list price only two-thirds that of the nearest American competitor. The new point-to-point drilling machine was designed for mass production which requires the use of the first eleven prototypes of the machine around the clock to trim its own manufacturing costs. The West Hartford, Conn., firm's management has such confidence in the new equipment's ability to reduce the user's drilling costs that it makes a ninety-day money-back guarantee.

The Tape-O-Matic drill (heading illustration) is a standardized unit having an engineering concept in which the machine and its solid-state electronic control unit are designed for manufacturing simplicity and reliability as a complete package.

For example, the machine not only drills its own metal parts, Fig. 1, but is also used to drill its own printed circuit panels, Fig. 2. In another novel setup it is used to wire-wrap the interconnecting board terminal blocks in which the printed circuit panels are plugged, Figs. 3 and 4. The electronics are greatly simplified to modules,

and are manufactured according to missile hardware reliability concepts under mass-production methods. The fine-adjustment positioning systems of the two table axes are unusual in that they involve a photoelectric feedback arrangement with a metal or plastic rotary "quantizer" disc (heading illustration), instead of feedback by inductance. Incidentally, drilling of the discs is done by prototype of the machines, Fig. 5.

New design features virtually eliminate static and dynamic friction problems in order to obtain the full potential of numerical-control benefits. The control system uses the closed-loop cycle. The two slides move independently and simultaneously for unusually rapid and exact positioning of the work done under the drill. One quantizer disc is mounted at the end of each table feed-screw. The disc is arranged with a series of evenly divided opaque radial segments. This is so placed that a beam of light to a photocell is interrupted by one of the opaque segments for every 0.001-inch motion of its slide. Thus, a distinctive electrical pulse is generated for each 0.001-inch movement of the slide. Simultane-

Fig. 1. (Top) Bracket for an as-yet incomplete Tape-O-Matic drilling machine is typical of the parts turned out by prototypes of the machine at minimum cost.

Fig. 2. (Center) Holes are drilled by the tape-controlled P&W drill in printed circuit boards. These four panels make up the majority of the logic circuits used in the numerical controls of the machine.

Fig. 3. (Bottom) Taped program of terminals takes hunting time and guesswork out of wiring by spotting successive terminals under the tool-rest bracket for the wrapping tool.

Machine tools, unique because they can make parts for themselves, have now been pushed into a new generative perspective. Prototypes of Pratt & Whitney's new Tape-O-Matic digital drilling machine were engineered to be economically indispensable in the mass-production manufacturing of the drills now on the market. Cost is within the grasp of the smallest firm. No computer is needed.

ously, the controller's tape reader is generating another series of electrical pulses signifying "where the table should be." The quantizer's signals represent "where the table is."

Electronic comparison of the two different signals produces a difference in the number of pulses, representing how much further, in what direction, and how fast the particular slide must move with the work to arrive at a position where the signals are equal, or at "set point," ready to drill. Of course, the signals have to be amplified to drive the servo motors and thus to "close the loop." Logic circuitry is composed of transistorized, plug-in printed circuit boards arranged in a NOR configuration.

The standard machine has a 30- by 20-inch table with 1 1/2 hp at the spindle. Benefits are: higher percentage of machine utilization; elimination of high costs and long delivery; lead times to design and build jig templates and drill jigs; and savings in inventories of jigs, their storage costs, and the taxes on them. Further advantages are: the elimination of extra operations where runs are too small to justify making drill jigs; the reduction of inventories of finished parts be-

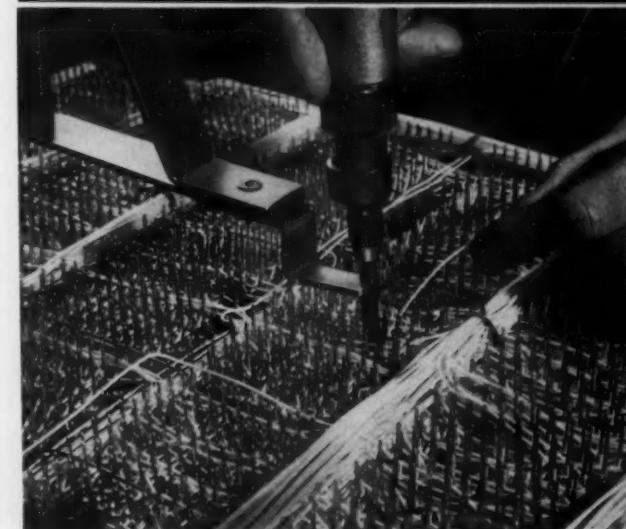
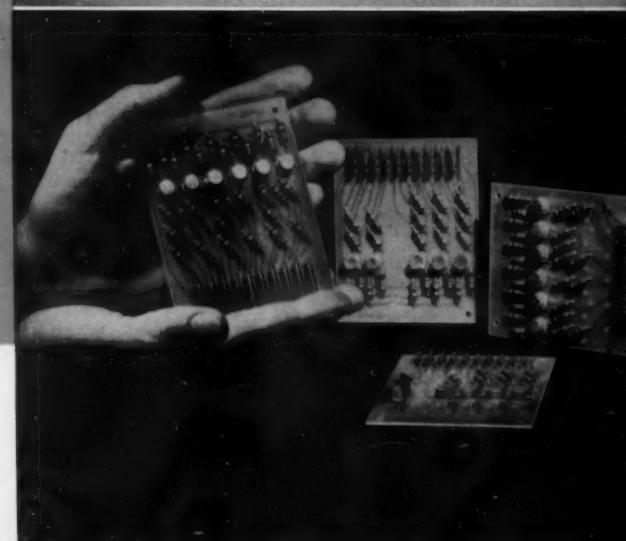




Fig. 4. For wiring its own panels, the tape control (left) positions interconnecting board terminal blocks into which printed circuit panels are plugged.

cause lead time can be shorter; reduction of scrap losses because the tape, once verified, cannot make a mistake; and reduction of inspection time because tape control is reliable. It uses original data, and thus first-piece inspection will suffice for an entire run of parts.

Of course, it is necessary to plan, program, and punch the tape. These now become office jobs that are performed at far lower expense than on the work-bench or the machine table. Time at an office desk is much cheaper than time on the bench, when an idle machine's hourly rate must be added to the labor rate of the man on the bench. Naturally, the tape rendition takes the services of an estimator or control clerk who can read engineering blueprints, and who understands drilling practice, tooling, and metal-cutting problems.

For example, a control tape for an orifice plate, with three tool changes and a total of fifty-one

holes to be spotted and drilled, required only two hours of the data-processing man's time, and one hour of the typist's time to punch the paper tape, for a total maximum cost of \$15. The job can be run the same day. To have built a conventional drill jig for the same part would have cost \$500 plus a lead time of three weeks to design and manufacture.

Contributing importantly to the machine's ease of programming and setup is capability of the controls to use dimensional information which can be either positive or negative in numerical value, since the machine incorporates "floating zero." This feature permits the machine to operate in all four quadrants. At setup the operator has much greater ease and speed because the floating zero permits him to zero-in his work-piece anywhere within the travel limits of the table.

Design of the drilling machine is simple and rugged, with the base, column, and head of welded construction for superior strength and rigidity. Cylindrical ways and recirculating ball bearings are used to minimize static and dynamic friction. Backlash, or lost motion, at reversal points is eliminated through the use of preloaded recirculating ball-bearing feed-screws and nuts.

A great effort has been made by Pratt & Whitney engineers to design and produce this tape-controlled unit so that it can be maintained by regular, small-plant personnel, and without the need for specialized engineers on maintenance and data preparation. For example, only four different printed circuit modules are used. The machine is delivered with a maintenance package, called the "doctor's kit." The company, in

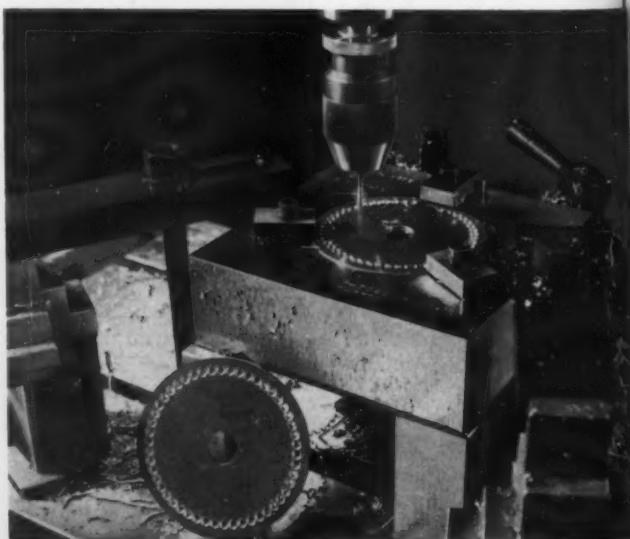


Fig. 5. Quantizer discs are held for drilling in this fixture on the table of the new Tap-O-Matic drill.



Fig. 6. Indicators on the control panel of the director box permit regular shop personnel to pinpoint any circuit failure.

spite of the reliability built into the whole drilling system, takes a realistic view of possible service requirements in its five-year guarantee of component parts. The kit, therefore, contains spare modules of system elements which may, in the course of time and use, need replacement. The system is designed with "telltale" which show which elements have failed, Fig. 6. A carefully prepared trouble-shooting manual enables most electronic repairs to be made simply by unplugging one element and replacing it with another from the kit.

Programming of the Tape-O-Matic drill is primarily designed to be done by existing plant personnel, using a Friden Flexowriter tape-punching typewriter or the equivalent. However, there is no reason why it cannot be used effectively by large firms who have computers at their disposal. (Where a small firm needs computer programming, it can use the services of one of the

many data-preparation centers that now exist all over the country.)

The Tape-O-Matic can be used in conjunction with an intermediate-sized computer to generate the instructions that prepare tapes for point-to-point machine tools. This program operates on the solid-state IBM 1401 data-processing system, developed jointly by Pratt & Whitney and International Business Machines Corporation. It requires only a basic configuration of the IBM 1401.

Users of the program need provide the computer with only a brief description, with simple numerical statements of holes to be drilled in a given work-piece. The computer then calculates the positioning operations to be performed by the machine in drilling, countersinking, or tapping. The benefits of using the computer are, obviously, greater speed and more accuracy in programming for tape control. The coding of instructions produced by the 1401 computer conforms to standards of the Electronics Industries Association for numerically controlled point-to-point machine tools guided by eight-channel perforated tape. Thus the same program can be used with only slight modifications with any combination of tool director and drilling machine meeting these standards.

The drilling machine table and associated tape control are available as a separate unit without the column and drilling head, Fig. 7.

The Tape-O-Matic drill is normally supplied with manual spindle downfeed, at \$8595. A power downfeed unit is available at extra cost. Another accessory is a visible three-digit operation number read-out package that can be added to the control system.

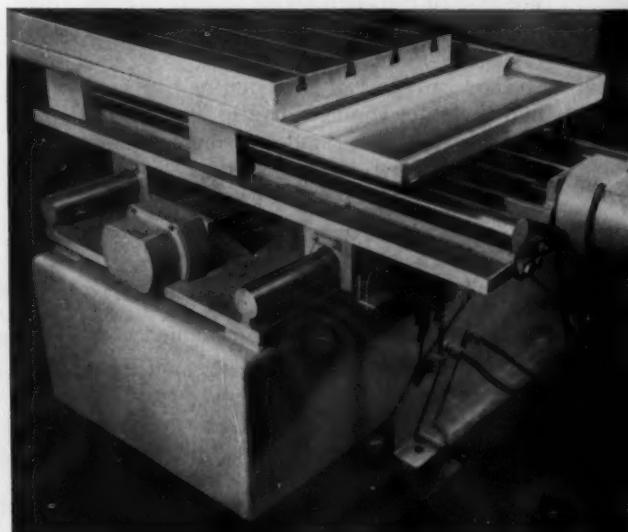


Fig. 7. Table of the Tape-O-Matic is available with its controls as a separate positioning unit for application to operations other than drilling.



In the panoramic design technique, designs are made on wall-size blackboards instead of drawing-boards. Approved designs are photographed for use in manufacturing and assembling.

Panoramic Design Technique Cuts Research and Development Costs

A simplified method of illustration, which cuts engineering, design, and drafting costs from 33 to 50 per cent, has been developed by T A B Engineers, Inc., a Chicago consulting engineering firm. Called the panoramic design technique, it eliminates drawings made with conventional drawing-boards and drafting instruments. Instead, the engineers make their designs directly on wall-size blackboards, and record them photographically.

Time records showed that an average of 78 per cent of the engineering time previously spent on a project was devoted to layout, detailing, and revisions. Many engineers and designers often worked on parts of a design at the same time, and the chief engineer had to look at their work individually. This same drafting work using the new method has been slashed to 34 per cent.

With the panoramic design technique, engi-

neers and designers work together as a group at a huge blackboard. Each man is assigned a specific part of the design to develop and his ideas are constantly on display as he progresses. The director can see the over-all project instead of inspecting individual drawings. If a change is indicated, it can be made by just erasing the chalk and sketching a new version.

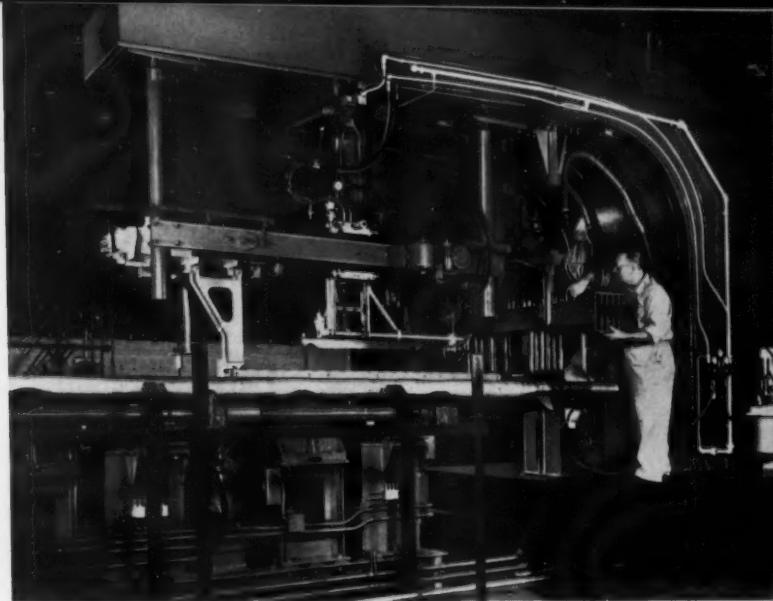
By sketching the design on the blackboard full-size or larger, the entire assembly and the component parts can be visualized more easily. When a satisfactory design is developed, detailed drawings can be made immediately by the use of ruled plastic overlays. Photographs of the design are taken for customer approval, for use in manufacturing, and for assembly. By sharply reducing time-consuming detail work at the drawing-board, the engineers and designers are freed for creative thinking.

Egan Expansion Centralizes Manufacturing Operations

Frank W. Egan & Co., Somerville, N. J., celebrated its fifteenth anniversary with the completion of an expansion program that has doubled its plant facilities. All manufacturing will now be consolidated under one roof. This company, which has recently entered the metalworking equipment field, makes coil stock feeds and other accessories and machinery for the metal-forming

industry. It is also a leading manufacturer of plastic extrusion coating machines, plastic extruders, and paper converting and handling equipment. The new facilities include an additional 26,000 square feet for manufacturing purposes as well as 12,000 square feet for engineering. Substantial space has been added to the company's sheet metal and machine tool departments.

Read-Out System Weighs, Measures, and Marks API Coded Pipe Automatically



The machine setter adjusts a portion of the automatic stencil-shifting carriage. To its left, also supported by the C-frame, is the reciprocating spray paint head by which the pipe is marked through the stencils selected in the computer.

HEAVY OIL-FIELD PIPE, accepted in lengths to 50 feet 2 inches and in 4 1/2 to 10 3/4-inch diameters, is length-measured to accuracy within plus or minus 1/2 inch, weighed to within 1/10 of 1 per cent, and stenciled by a new system automatically. Built by the Industrial Equipment Division of Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa., the equipment prints a read-out record for each individual pipe. Its computer also counts total pieces, computes weight per foot, and indicates and prints total accumulated weight and length in accordance with the oil-field code of the American Petroleum Institute. Compliance is a condition of acceptance.

Only one part-time attendant is needed. This compares with crews of four to eight men formerly required for weighing, measuring, tallying, and stenciling according to the pipe code standards. The machine measures 65 feet in over-all length. It consists of a complete mechanical installation for mill handling of heavy pipe, a special-purpose fully transistorized computer, and instrumentation and controls. Speed is in excess of three pipes per minute.

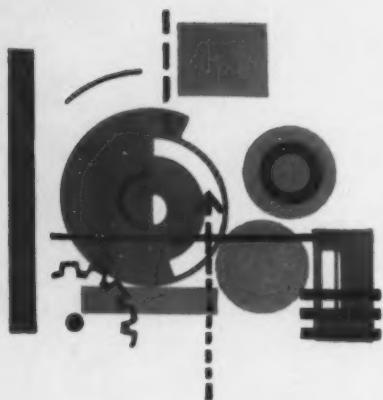
Shown in a working demonstration just before its delivery to a major midwestern steel firm, which already has two prototype versions of similar systems in operation for several years, the new system incorporates marked advances. These are reflected both in more rugged design of all mechanical components and in an improved system of electromechanical instrumentation developed and supplied to B-L-H specifications by Telechrome Mfg. Corporation, Amityville, N. Y.

Instrumentation, especially developed for steel mill conditions, is of modular, building-block

component design throughout. Relays, visual read-outs for each digit, programming switches, and all other components are sealed in heavy plug-in cases. This permits simple "remove and replace" maintenance of instrumentation by regular mill operators, without special tools. A tell-tale board shows any trouble area instantly. Lighted indicators sequence automatically with each weighing/measuring/computing/recording cycle, and pinpoint the failure of any unit in cases of malfunction in instrumentation or control. The faulty unit is then simply unplugged and replaced.

Pipe entering the system is carried from loading arms by a synchronized transfer mechanism. Upon entering the first of two stations, it is supported on a data-gathering bridge for length measuring, weighing, and counting. Feeler arms advance against the ends of the pipe, and a differential servo system translates the distance the arms move into an electrical signal proportionate to the length of the pipe. The weight is then compared by B-L-H load cells with a null-balance detecting system. From the weighing bridge, the pipe is transferred by escapement to the second station. Here markings are sprayed on the pipe automatically by a series of servo-controlled stencils on an overhead air-operated platform. Weight, length, and other abbreviated specification data are marked on each length in accordance with the American Petroleum Institute code requirements.

A memory device in the computer circuit permits the sequence-processing of two pipes, with stenciling of one pipe taking place while a second pipe is being measured and weighed.



Ingenious Mechanisms

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Straight-Line Motion Through Levers

B. R. OBRA, Detroit, Mich.

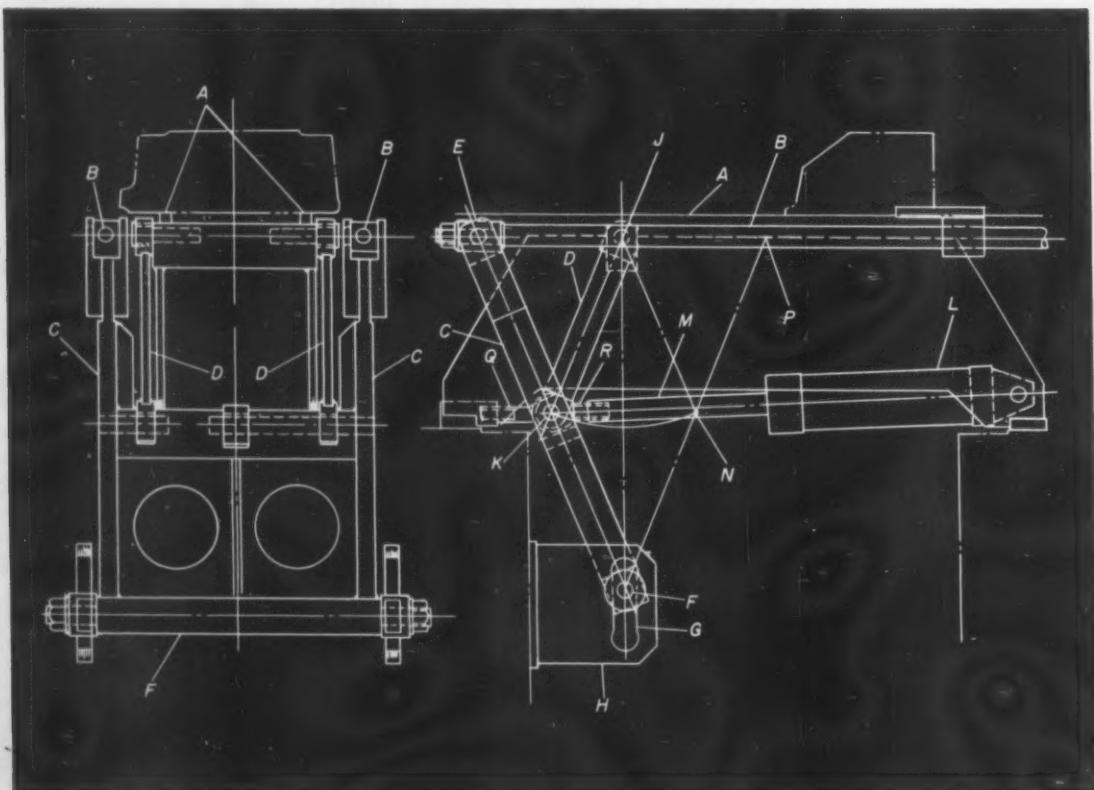
In processing clutch housings on a transfer machine, movement of the work from station to station is accomplished by the finger type mechanism illustrated. Features include simplicity of design, compactness, and a straight-line movement of the work.

Rails A support the housings. Along each side are a transfer bar B, transfer lever C, and link D.

Trunnion blocks E at the top of the levers join them to the bars. The bottoms of the two levers are attached to a common shaft F which is contained at each end in a bushing in a slot G of a bracket H fixed to the frame of the device.

Likewise, the tops of the two links D are fixed to the frame, by pins J, which are on the center line of slots G. At their bottoms, the links are

While the work is indexed in a straight line along rails (A), shaft (F), attached to transfer levers (C), falls and then rises in slots (G).



hinged to the centers of the levers by pins K. Links are one-half as long as the levers, with the distance between K and J equal to the distance between K and the center of trunnion block E.

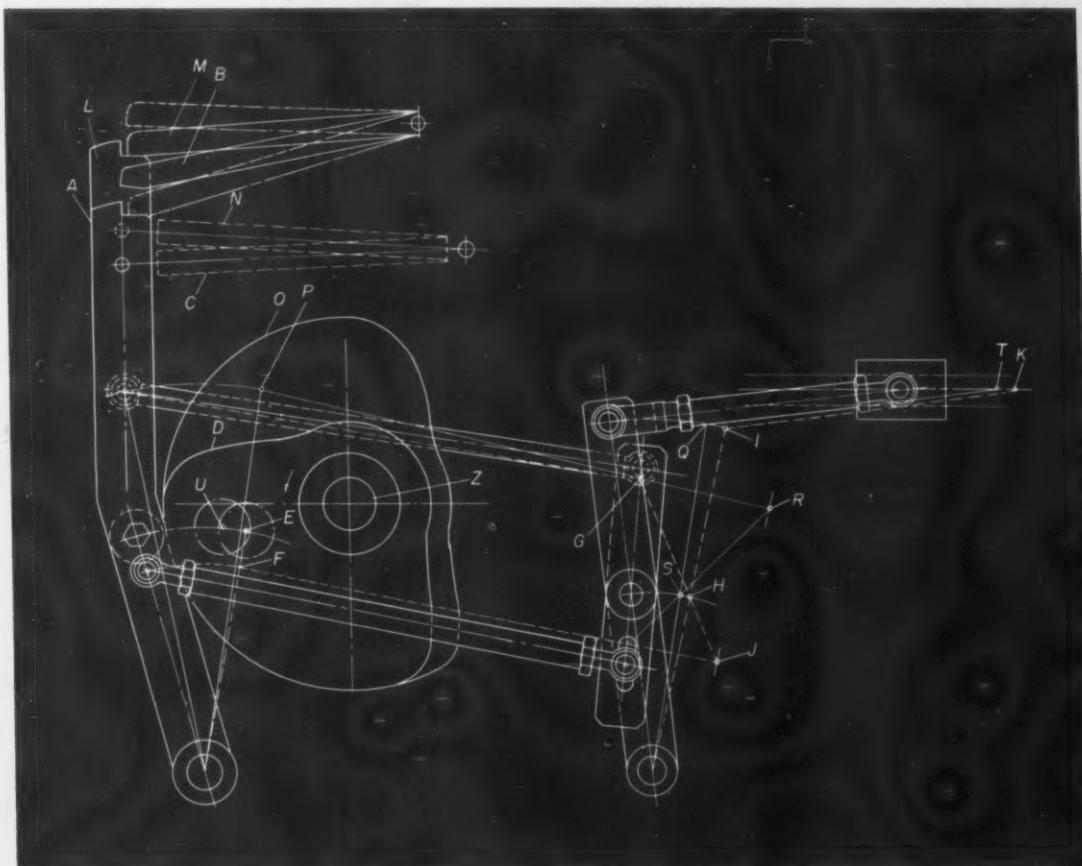
To operate the mechanism, air cylinder L powers connecting-rod M, attached to the levers at K. (The rod could be attached elsewhere along the levers, its position depending on the desired

ratio of piston stroke to transfer movement.)

When the connecting-rod pulls the levers, pins K move through an arc to point N, causing shaft F to fall and then rise in slots G as transfer bars B travel in a straight line to point P. Accurate limits to the indexing stroke are provided by stop-screw Q and by threaded clevis R on the end of the connecting-rod.

Slide Motion Differential

PREBEN W. JENSEN, South Norwalk, Conn.



The output motion to the slide, right, is changed in its stroke length by alternating the use of latches (B) and (M).

Packaging machines are often equipped with automatic inspection devices that discard cartons which, for weight or other reasons, are above or below standard. The packaging machine illustrated operates in the following manner:

The object is to change the length of slide stroke to position T or K by selection of latches M and B (see illustration). The drive is rotating shaft Z. Levers A and L follow open track cams D and O. This view shows lever L blocked out by

latch M. Lever A follows cam D under tension from spring C. Connecting-rod F is driven to the right, carrying the intermediate lever to successive positions G, H, J. The standing lever is thus carried to position I.

When lever A is latched out and lever L is allowed to follow cam O there is the same mode of operation but a different motion. The standing lever moves only to point Q, and the slide goes only as far as T.

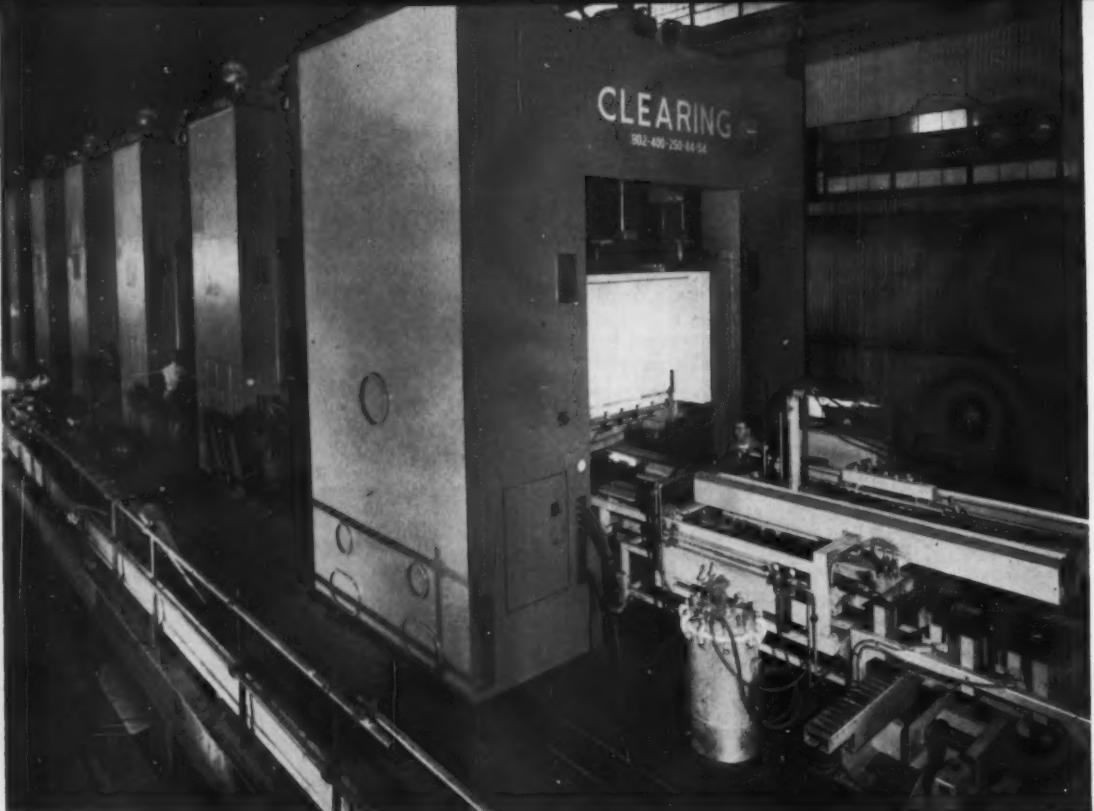
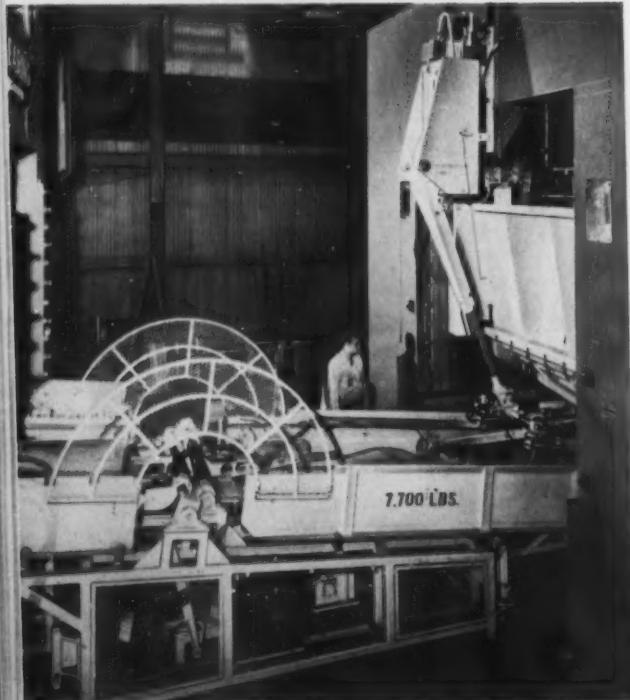


Fig. 1. (Below) Swinging-arm type unloader automatically removes drawn stampings from press and places them on a shuttle-feed unit, where they are turned over.



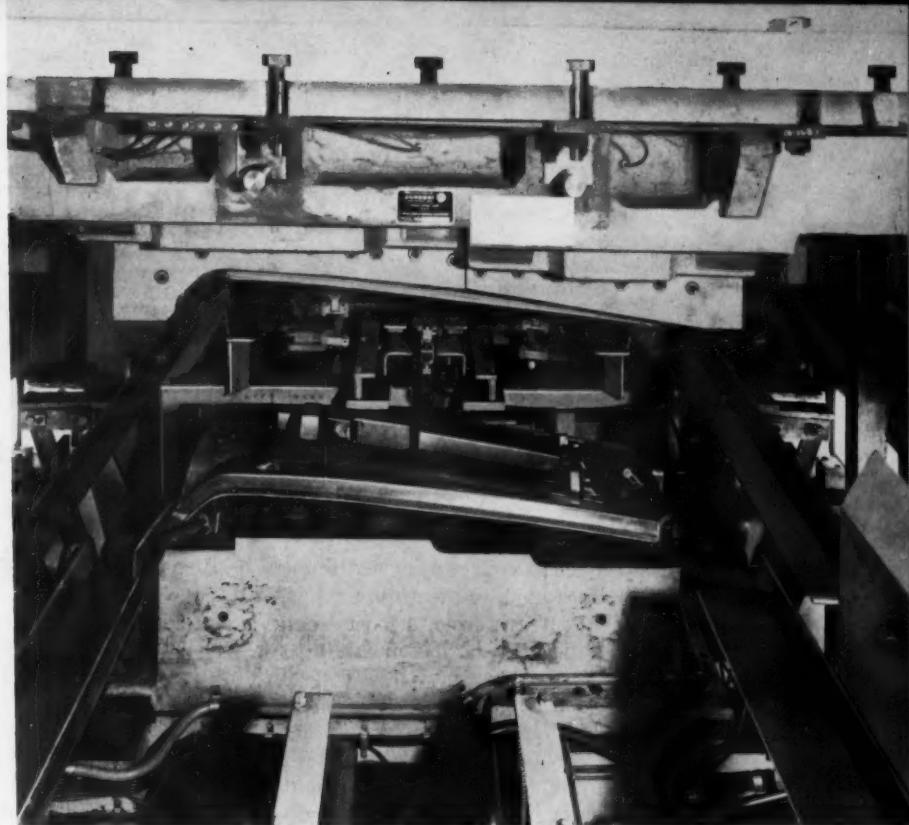
Automated Press Line

THE fully integrated, automated press line seen in the heading illustration was built by the Clearing Division of U. S. Industries, Inc., for the production of automobile fenders at Nissan Motor Co., Ltd., Tokyo, Japan. It is one of four press lines (a total of twenty-three presses) Nissan has ordered from Clearing at a total cost of nearly \$5 million. This is believed to be the largest single order for equipment built in this country and destined for overseas shipment. All the equipment is being delivered within one year from the date the order was placed.

Full responsibility for the entire job, from blueprint to finished part, was assumed by Clearing. The equipment was erected on their assembly floor in Chicago, and operated as it will be in Japan. The fender production line shown consists of six presses, connected by automatic transfer mechanisms, and weighs a total of 700 tons. Only two operators are required for the entire automated line, which has an hourly production rate of 1200 units.

The first press in the fender production line, for drawing the blanks, is a double-action, bottom drive type, powered by a 100-hp motor. It has an

Fig. 2. Close-up view of one of the dies on the automated press line seen in the heading illustration. Shuttle-feed units are also shown.



e Produces Fenders for Japanese Cars

inner slide stroke of 27 inches and capacity of 400 tons, an outer slide stroke of 19 inches and capacity of 250 tons, and an air cushion stroke of 8 inches and capacity of 65 tons. The other five presses are of the single-action, eccentric gear type, each having a 40-hp main operating motor. Capacities of these presses are 400 tons, with slide strokes of 16 inches. Each press has an air cushion with a stroke of 6 inches and capacity of 60 tons.

Blanks are automatically placed on the die in the first press by means of a sheet loader, seen at the lower right in the heading illustration. When a blank is in the proper position, a limit switch starts the press to make a one-stroke cycle. Drawn stampings are automatically removed from this first die and placed on a shuttle-feed unit, Fig. 1, by a swinging-arm press unloader. The unloaders, as well as the loader and other automation units, were made by Press Automation Systems, Inc., Detroit, Mich.

Drawn stampings are advanced by the shuttle feed to a turnover station, where the parts are inverted for the subsequent operations. The inverted stampings are moved by the shuttle feed

into the die on the second press. Here, the sides of the stampings are rough-trimmed, and the rear edges, finish-trimmed. Swinging-arm type unloaders are provided on all five of the single-action presses, and shuttle-feed units transfer the parts between the presses. Limit switches and electrical circuits automatically actuate each press when the stampings have been properly positioned in their dies.

The third operation consists of rough-trimming the front edges with a cam-actuated die. On the fourth press, the sides and rear edge of each stamping are flanged, and a restrike operation is performed on the front edge with a double-cam die. A cam-actuated die is also employed on the fifth press to finish-trim the sides and front edges, and pierce a total of twelve holes in each stamping. In the sixth operation, the stampings are parted along their center lines and flanged, four holes are cam-pierced, and notches in the front edges are cam-trimmed. A typical die, and the shuttle-feed units into and out of the press, are shown in Fig. 2. Completed stampings from the final press are automatically unloaded and placed on conveyors.

Tool Engineering IDEAS

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work



Shaping and Slotting Fixture for Hand Miller

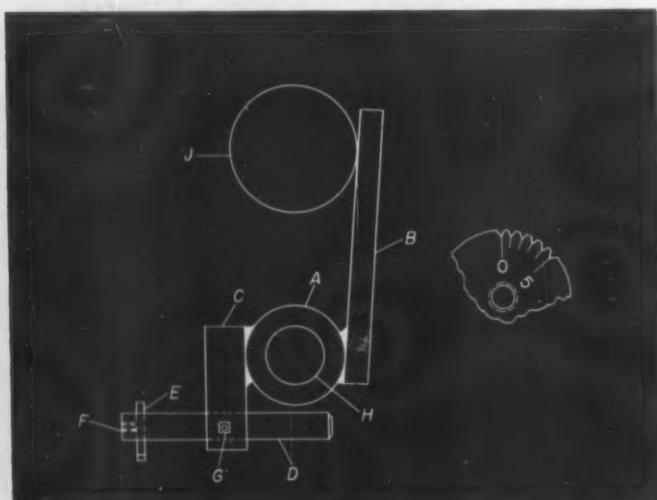
DONALD A. BAKER, Boonton, N. J.

Occasionally it becomes necessary to shape some pads on the inside of cast-iron box jigs. When there is no shaper available, a fixture can be built up by welding, as at the left in the illustration. This consists of a piece of heavy steel tubing *A* and two pieces of steel *B* and *C*. Through bar *C* a 3/4-inch hole is reamed to accept round bar *D*. This bar is movable axially in the slot and is held by set-screw *G*. Tool *E* is held in one end of the holder by set-screw *F*.

Lately, in the manufacture of a precision sight for a pistol, some nuts were required which were

graduated on the face and had corresponding grooves cut in the rim, as shown in the enlarged view (inset at the right).

The fixture has proved practical for both shaper jobs. In use, tubing *A*, which was bored to fit over 1-inch bar *H*, is clamped in place on the miller arbor. Heavy rubber bands hold bar *B* to the overarm of the miller *J*. The bands stretch, releasing tool *B* on the back strokes. Work is clamped on the miller table, and cuts are made by either moving the table or the arbor head, using their respective hand levers.



Shaper tool extension permits interior cutting and grooving of the edge of the pistol nut graduations at the right.

Taper-Generating Tools for Screw Machine

M. W. LOFTUS, Chicago, Ill.

Cylindrical parts like that in Fig. 1 were required in production quantities. The available screw machines and turret lathes had no taper-generating tools. Therefore, it was necessary to

develop a satisfactory cross-slide attachment (Fig. 2) that would be effective, inexpensive, and offer an easy means of setting the tools; that would keep production and tool costs low; and

which would also yield the specified accuracy.

Boring-bar A with the cutter B, mounted as in section T-T, slides in a channel slide holder C. Feed on the bar is delivered by flat-faced plug D, pushed by the turret against follower roller E. Cover plate F retains boring-bar A. It is spring-loaded by compression spring G, which lies in a slot against pin H to return the bar.

The slide mounts on a welded pedestal, clamped to the screw machine cross-slide by T-nuts, as at J. The pedestal is positioned by keys L, which fit the T-slot. Resting on the pedestal, the tool-slide pivots on pin M. The top plate of the pedestal has segment slots for studs N, which lock the slide in place at the correct angle for turning the taper.

When setting the attachment to turn a required taper, a test bar is first trued on the machine chuck. At two places along the slide channel are reference studs P. The rear stud is brought into contact with the test bar, as in Fig. 1. Then the angle of the slide channel is adjusted to suit the predetermined dimension X. The convex surfaces are spaced a distance apart that is convenient for

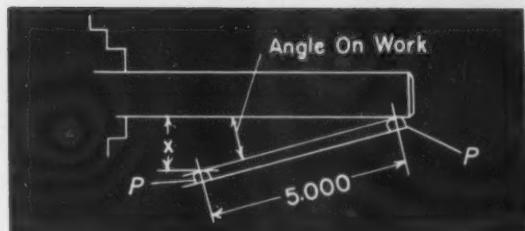
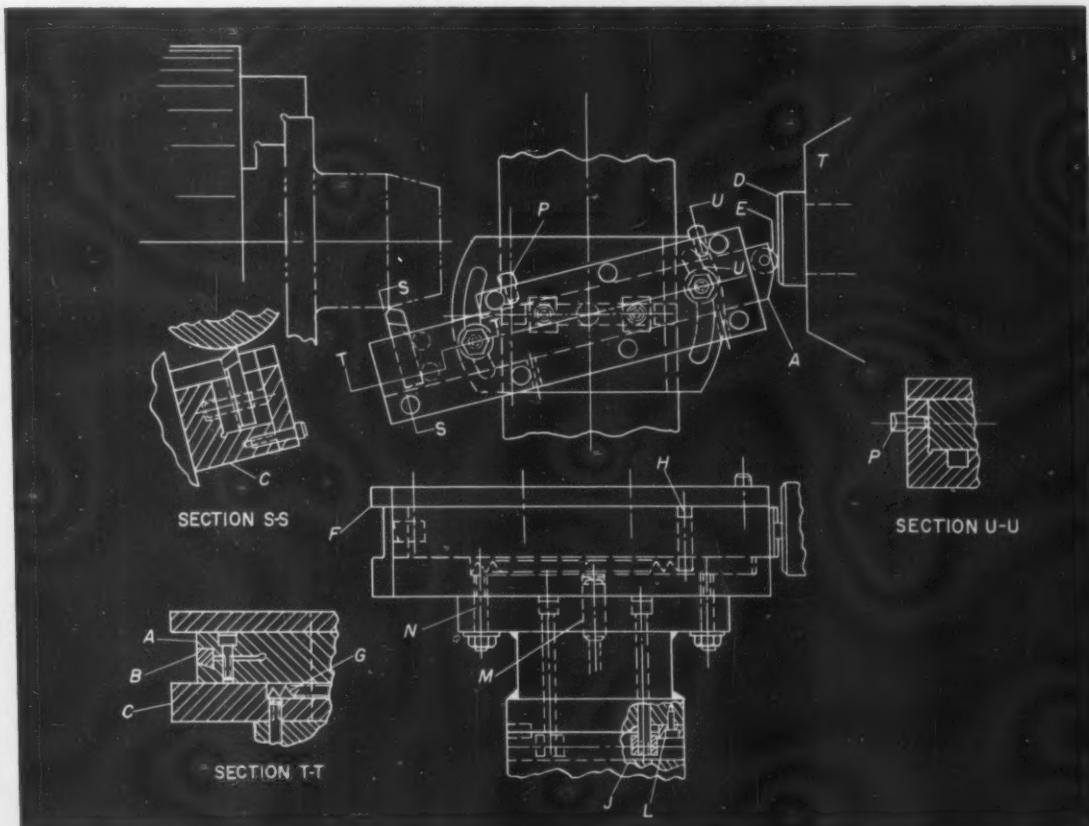


Fig. 1. Typical taper-generating problem solved by the lathe tooling shown in Fig. 2.

rapid computation—in this case, 5.000 inches. To determine dimension X, it is only necessary to find the sine of the part angle on a logarithm table, move the decimal point one place to the right, and divide by 2. The dimension can also be found in a table of sine-bar constants, (for example, page 1367, MACHINERY'S HANDBOOK, Sixteenth Edition). A convex wheel was used for grinding the radius on studs P at the 5.000-inch spacing after assembly in their mounting holes, section U-U. Consequently, the original drill spacing need only be approximate.

Fig. 2. Attachment for lathe cross-slide provides adjustment for generating a convenient range of commonly used tapers.



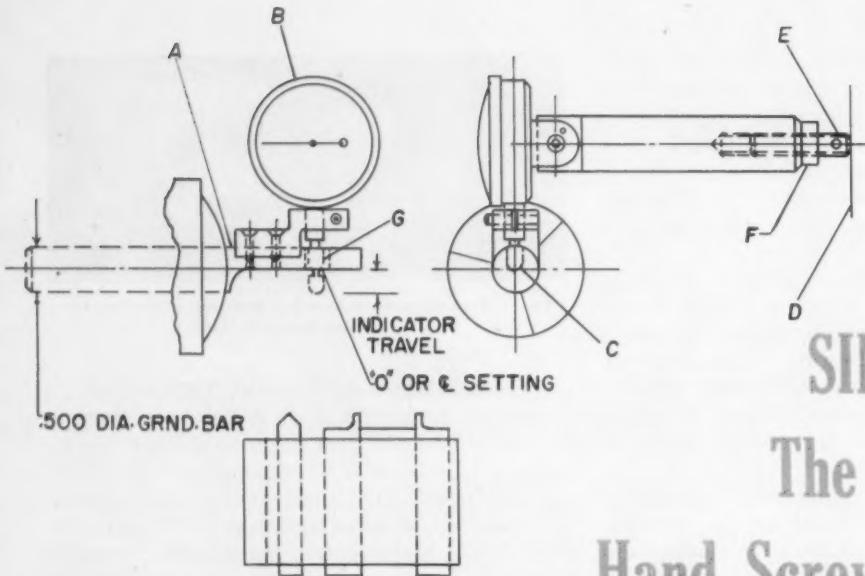


Fig. 1. Fixture that speeds accurate setting of tooling on hand screw machines.

THE HAND SCREW MACHINE is convenient for making parts in quantities insufficient to warrant the use of an automatic screw machine. A variety of tooling is available that enables all stations of hand screw machines to be employed for both single and combined operations. When properly set up, these machines are comparatively simple to operate, the key to best use of the equipment being tooling which makes setup fast and accurate.

A good way to assure rapid and precise setups for repetitive jobs is to retain a machined bar end piece when finishing a lot of parts. This piece can be placed in the collet and used to set the tooling when doing the job again. For initial set-ups of cross-slide plunge-cut tooling, the tool-setting fixture shown in Fig. 1 has been found useful.

The fixture consists of an accurately ground bar *A* to which a dial indicator *B* is attached. The bar, in turn, is held in a collet and adjusted so that flat *C* is perpendicular to the cross-slide *D*. This is accomplished by means of adjusting screw *E*. Once the flat has been adjusted to the vertical position, the adjusting screw can be locked by nut *F*. The adjustment will then remain fixed for future setups in the same machine.

The dial indicator must be zeroed to the center line of the spindle. This is done by placing a flat-surfaced piece or gage-block against flat *C* and then moving the indicator point *G* against the gage-block to the center-line position. Next,

SIMPLIFYING The Tooling of Hand Screw Machines

J. J. REIFEL, Tool Engineer
Electric Storage Battery Co.
Raleigh, N. C.

the indicator is advanced until the needle has moved approximately three-quarters of its total travel. At this point the dial is set at zero and the indicator is locked in place.

Tools can be set in relation to the center line of the work-piece by advancing them against the indicator point until one-half of the diameter to be cut is read on the dial. The cross-slide stop is then adjusted for this tool position. All succeeding cross-slide tools can be positioned according to the established indicator (center-line) setting in the same way.

The adjustable tool-holder seen in Fig. 2 will serve well with the setting fixture here described. It is a modification of commercially available tooling. Illustrated is a combination of accurately sized tool bits and spacers arranged to provide a fast, economical setup for machining grooves in shafts for rubber O-rings. In practice, this tooling has been found adequate for many shaft-grooving operations.

The multiple tool-holder *H* is designed for attachment to the cross-slide of the machine and is large enough to accommodate 3/8-inch tool bits. It is important that the tool bits have very accurate width dimensions so that accumulation of size inaccuracies is minimized. The necessary tool bits are inserted in the holder, and spacers *J*, as required, are inserted between them.

Clamping screws *K* are first tightened sufficiently to apply only a slight clamping force against the side of the stacked tool bits and

spacers. Clamping screws *L* are then also tightened to apply a slight clamping force on the top of the stacked tool bits—but not on the spacers. Next, tool-setting screws *M* are adjusted to position the tool bits so as to produce the required part diameter. At this stage of the setup, the tool bits can be positioned relative to the center line of the part by use of either the tool-setting fixture (Fig. 1) or a bar end piece. After all tool bits are correctly positioned, the clamping screws are fully tightened, except for those screws *L* located over the spacers. The multiple-tool setup is then complete.

The tool shown in Fig. 3, when provided with spacers *N* and cutting tools as accurately sized as those used for the external grooving setup, can provide a quick versatile means for producing internal grooves. The internal grooving tool is designed for attachment to the cross-slide; adapter *P* is made to fit the equipment to be used. In addition, the tool can be used in adjustable boring heads for internal grooving on a milling machine or a jig borer. The cutters and spacers are ground to accurate thickness tolerances as before and are stacked to obtain the required dimension *X* between the grooves. Cutters *Q* are similar to standard circular cutoff tools, and all spacers and cutters are keyed to the arbor *R* to prevent rotation during the machining operation.

Since the key establishes the relationship between the cutting edge of the tool and the arbor, the cutters must be sharpened the same amount relative to the key slot if the tolerances on the depths of the grooves are to be closely held. If this is not done, the cutting edges will not be in the same plane relative to the center line of the part and the depth of the grooves will not be equal. The cutter relief will also affect the groove depth if an equal amount of material is not ground from the face of the cutter.

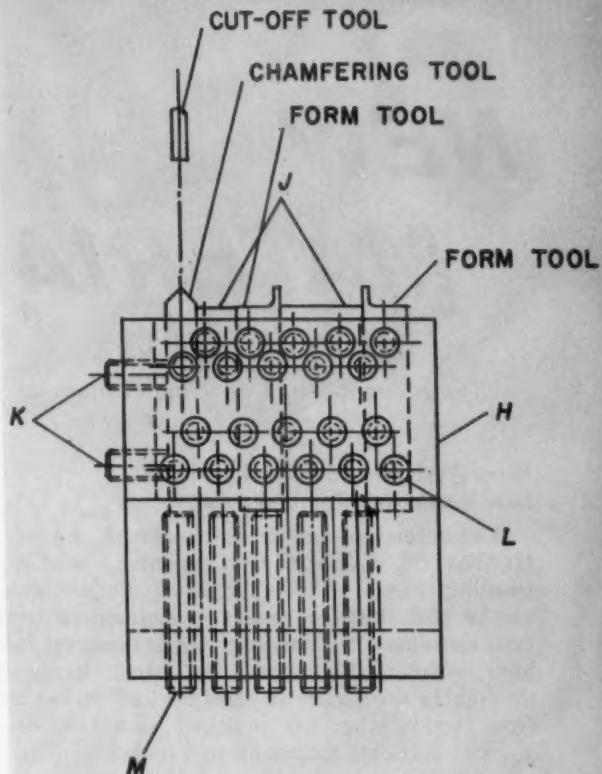


Fig. 2. Multiple-tool setup for cutting accurately spaced grooves in shafts.

The best way to prevent unequal grinding of the cutter faces is to sharpen the cutters while they are on the arbor. This can be accomplished by clamping the arbor either in a V-block or between centers with the cutting surfaces parallel to the grinding machine table so that the faces can be ground simultaneously.

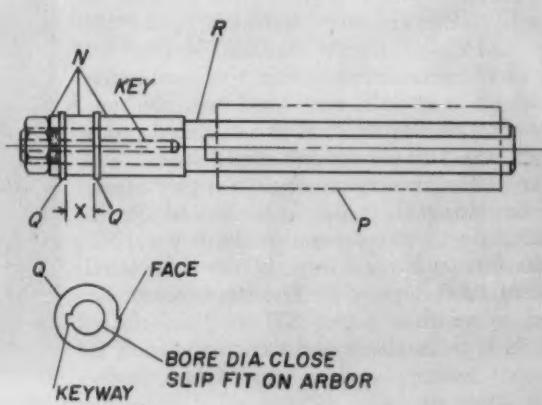
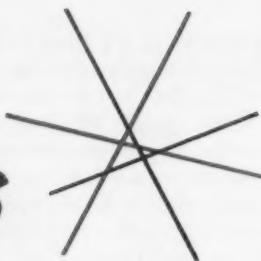


Fig. 3. Tooling arrangement, similar to that in Fig. 2, for producing internal grooves.

NEW MATERIALS

Paul B. Schubert



The properties and new applications of materials used in the mechanical industries

Wear-Resistant Tool Steel with Low Hardening Temperature

A tungsten tool and die steel called Carpenter Hi Wear 64, developed by Carpenter Steel Co., Reading, Pa., is a deep-hardening grade which can be heat-treated at much lower temperatures than those required for other steels designed for high wear applications. The steel hardens through to the center in sizes up to 6 inches in cross section when oil-quenched from 1450 degrees F. Intricate shapes up to 2 inches in diameter can be air-hardened from 1550 degrees F. The relatively low hardening temperature of the steel offers maximum protection against the danger of decarburization, distortion, and surface damage. It is essentially a nondeforming tool and die steel, with minimum size change occurring after tempering at 300 to 400 degrees F. A 1-inch piece, for example, when air-treated from 1600 degrees F. will expand about 0.001 inch when hardened. But it will return to within 0.0005 inch of its original length when tempered at 300 to 400 degrees F.

The steel is recommended for all kinds of punches and dies, including draw, lamination, and blanking dies. It is not designed for red hardness, and therefore should not be used for applications where service temperatures exceed 350 degrees F. The material may be used for tools to blank and form abrasive materials, phosphor bronzes, and nickel strip. It may also be used for making mold plates employed in the production of refractory materials, and for feed-rolls handling abrasive materials such as hot-rolled products with poor surface condition and scale.

The steel forges very much like high-carbon, high-chromium steel. It should be heated slowly and uniformly to a temperature between 1900 and 2000 degrees F., and forged from a die temperature of 1900 degrees F. The steel cannot be annealed softer than about 255 to 265 Brinell. Despite its high hardness and wear resistance, it machines at least as well as high-carbon, high-chromium type steels.

Circle 565 on Readers' Service Card

Stainless-Steel Strip with a Highly Reflective Finish

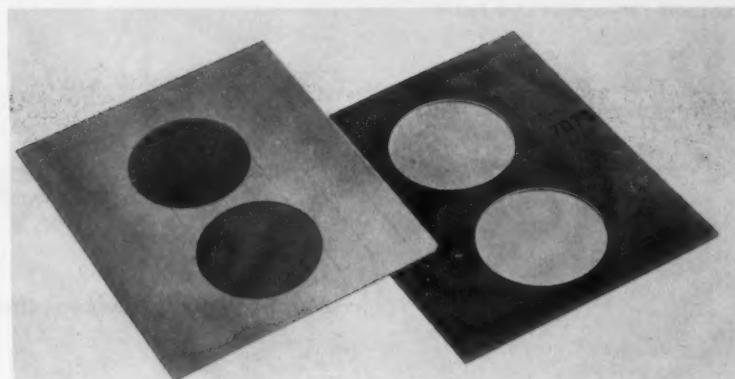
The commercial availability of stainless-steel strip with a highly reflective finish has been announced by Universal-Cyclops Steel Corporation, Bridgeville, Pa. The finish, called Unibrite, is imparted to both surfaces of the strip as an added production step. The finish improves the corrosion resistance of the strip, and its high reflectivity proves useful for automobile, appliance, and houseware manufacturers.

Circle 566 on Readers' Service Card



Stainless steel is now available with both sides buffed to a very high reflectivity, as can be seen by this sample coil.

The piece on the left is masked prior to chemical milling operation using a Mylar masking tape. The piece on the right is a similar piece after the chemical milling operation has been completed and the masking tape removed.



Masking Tape for Chemical Milling Operations

A masking tape containing a tough silicone adhesive which resists the chemicals in etching solutions has been announced by Mystik Adhesive Products, Inc., Chicago, Ill. Called Mystik No. 7300 Mylar tape, it will not lift off the part being etched during etching. As a result, the solution is permitted to contact only the exact area specified for etching, and accuracy is assured. Use of the tape saves time, as compared to spray coating.

Circle 567 on Readers' Service Card

Acrylic Sheet that Is Tough, Craze-Resistant

An acrylic sheet that combines the outdoor weathering properties of Plexiglas with punchability, flexibility, toughness, and craze resistance has been made available by Rohm & Haas Co., Philadelphia, Pa. The material, called Tuffak, is being offered as a colorless sheet in two sizes; 42 by 42 inches and 84 by 84 inches, in 0.050-inch thickness only. It is reported that the material can be nailed or punched without cracking if proper techniques are used. The sheet can be readily cold-formed. Stamping at 90 degrees F. with punch and die sets equipped with stripper plates is recommended as a production technique. Its use as a glazing material is promising.

Circle 568 on Readers' Service Card

Graphite Electrode Stock Developed for Electrical-Discharge Machining

A graphite stock, designed to be of special use to die manufacturers in electrical-discharge machining operations, has been announced by Speer Carbon Co., St. Marys, Pa. Designated Speer Kostkutter graphite stock, the material possesses a number of inherent properties that promote speed in electrical-discharge machining while achieving important economies and convenience in use. The stock can easily be fabricated into any desired shape. The material is capable of removing large volumes of metal when in use,

while itself remaining in a relatively uneroded state. Its resistance to edge breakdown helps assure good cavity detail. It is available in sizes up to 12 by 12 inches by 2 1/2 inches thick. The material has a breaking strength (parallel to forming pressure) of 4000 psi, and a hardness (sclerometer) of 35.

Circle 569 on Readers' Service Card

Aluminum Alloy Provides Effective Control

An aluminum alloy especially formulated to resolve some of the major problems of aluminum patternmaking has been developed by American Smelting & Refining Co., New York City. Known as PT Aluminum Pattern Metal, the alloy provides effective control during casting by minimizing variations in shrinkage and eliminating occasional unpredictable extremes of shrinkage such as are experienced with most other pattern metals from time to time. The alloy's composition has been adjusted to improve machinability and to facilitate finishing operations such as filing and scraping, thereby cutting production time.

Circle 570 on Readers' Service Card

Blocks for Protecting Cross Supports on Flame-Cutting Tables

Cast-iron beehive-shaped blocks which fit onto cross supports of flame-cutting tables have been made available by Brown & Sharpe Mfg. Co., Providence, R. I., to eliminate costly maintenance. Flame-Clear rising blocks, as they are called, hold the steel plate clear of the table and prevent the flame from cutting and damaging the table bed. The blocks do not cut readily, as they have a great flame resistance. This assures them a long life. They may be quickly arranged on the cutting table supports according to the pattern of cut. Blocks come in two "standard" slot sizes, 5/16 and 3/8 inch.

Circle 571 on Readers' Service Card

NEW DEVELOPMENTS IN

Machine tools, unit mechanisms, machine parts, and

Natco-Delapena High-Frequency Induction-Heating Equipment

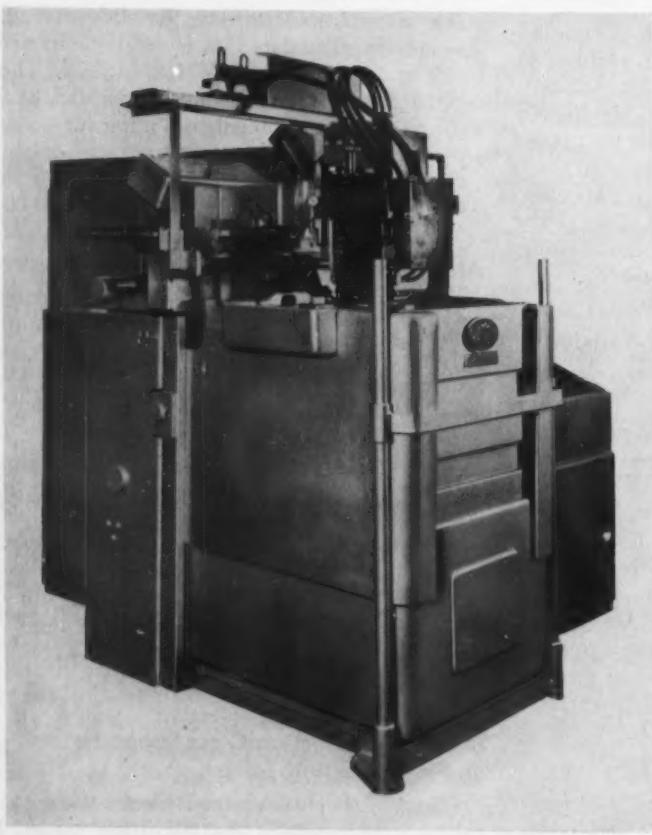
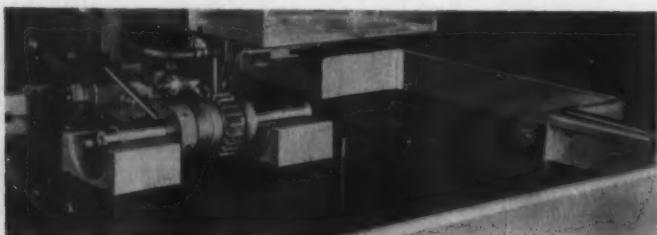


Fig. 1. (Above) Natco-Delapena high-frequency induction-hardening machine capable of handling wide range of gears. Fig. 2. (Below) Close-up view of traversing head and intensifier of machine shown in Fig. 1



The National Automatic Tool Co., Inc. (Natco), Richmond, Ind., has announced a new line of Natco-Delapena high-frequency induction-heating equipment. Through a cross-licensing agreement with Delapena & Son, Ltd., Cheltenham, England, Natco is now in a position to offer an extremely versatile line of oscillator-tube and motor-generator equipment for a variety of work.

Among the many advantages claimed for this oscillator-tube equipment are three principal devices for varying the power under all output conditions while still maintaining maximum efficiency. One is a unique infinitely variable matching transformer arrangement that provides fine control over power output. The second consists of special matching link connections for single- or multiple-turn work coils. The third is a booster condenser which provides additional output (kva) for specific loads.

An outstanding advantage of this unit is the use of an air-cooled oscillator tube designed to provide 600 per cent longer life. It also gives a much higher intermittent rating than the equivalent water-cooled tube. In addition to the tube, the cabinet is also sealed and air-cooled, practically eliminating the use of water cooling.

The Natco-Delapena "Cold Heat Process" features the use of a highly efficient patented "Intensifier." This device is particularly advantageous for hardening gear-tooth profiles, as distortion is reduced to a minimum, tooth loading can be increased over normal through hardening, and scaling is

SHOP EQUIPMENT

material-handling appliances recently introduced

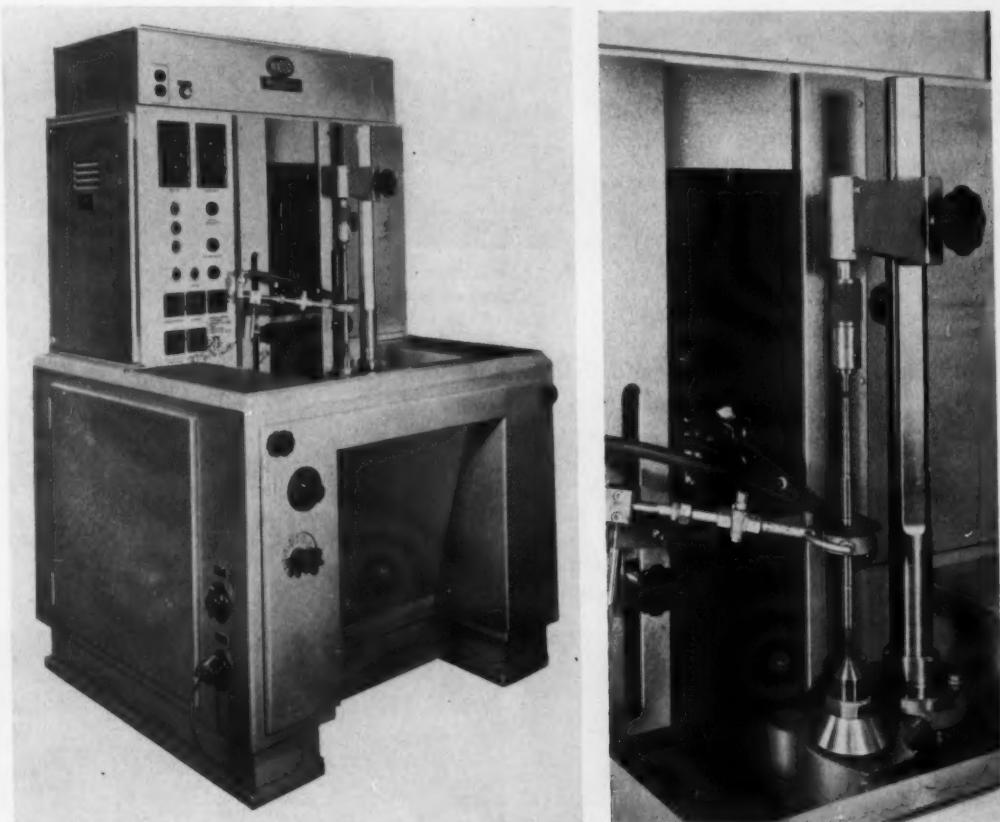


Fig. 3. (Left) Universal induction-hardening machine. Fig. 4 (Right) Close-up view of coil, quench ring, and fixture for shaft hardening on Natco-Delapena machine shown at left

completely eliminated. This process makes possible a good, hard wearing surface yet retains the original tough metal structure of the tooth form, thereby reducing noise level.

Oscillator-tube generators are available in sizes from 4 to 200 kw in either single- or double-output voltages. Standard motor-generator equipment is available in sizes

from 15 to 300 kw. Higher outputs are possible through the use of paralleling systems.

The induction-hardening machine shown in Fig. 1 is capable of handling spur gears, cluster gears, or helical gears up to 26 inches in diameter and a maximum face width of 10 inches. This machine is complete with 25-kw RF oscillator-tube type generator

and control console. It can be arranged for either semiautomatic or fully automatic operation.

A close-up view of a traversing head and intensifier for a gear-hardening machine is shown in Fig. 2. The intensifier is shaped to the contour of the tooth form of two adjacent teeth. This method gives a uniform hardness pattern around the adjacent tooth

faces, including the root. When this machine is in actual operation, the gear is completely submerged under the quenching medium being used.

Fig. 3 illustrates a Natco-Delapena universal induction-hardening machine. This type machine can be designed to handle shafts of almost any length and diameter. Provision can be made for handling parts on a rotating table or indexing table including automatic lifting equipment.

Fig. 4 is a close-up view of the coil, quench ring, and fixture for shaft hardening used on the machine shown in Fig. 3.

An intensifier for flat face hardening is shown in Fig. 5. Intensifiers of this type can be made to conform to almost any "way" section or other similar way shapes. Holding fixtures may be provided to handle machine beds or other parts as required.

Circle 572 on Readers' Service Card

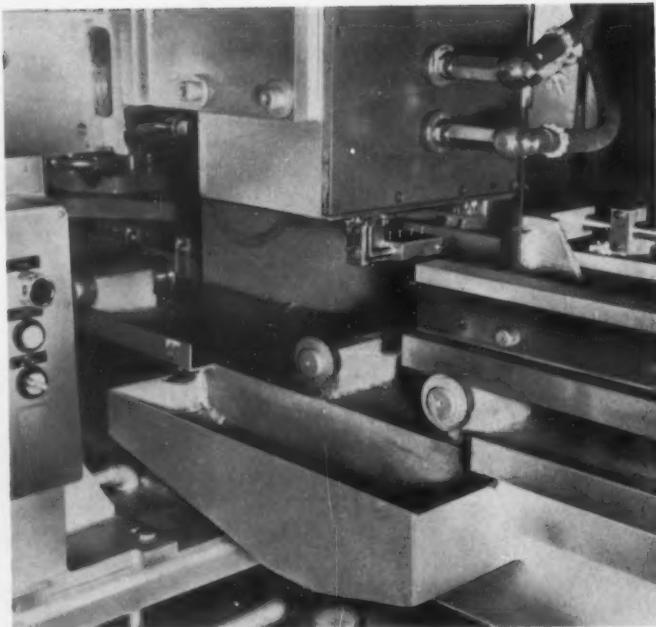


Fig. 5. Intensifier for flat face hardening used on Natco-Delapena equipment for treating machine ways

Four-Motion Abrasive Gear and Cylindrical-Parts Finishing Machine

A process for abrasive-finishing hardened gears and cylindrical parts, embodying a new four-directional relative movement between the work-piece and the abrasive tool, is announced by the Michigan Tool Co., Detroit, Mich.

New and improved abrasive tools, ranging from extremely fine to coarse grits for very fine finishes or rapid finishing, have been developed along with the new processing method.

Nicks and burrs can be removed

from the work-piece with ease, and some dimensional errors in lead and runout, involute, etc., can be corrected in a minimum of finishing time. Smoother and quieter running parts such as gears are said to be obtained without the necessity of matching or lapping.

The process has been incorpo-

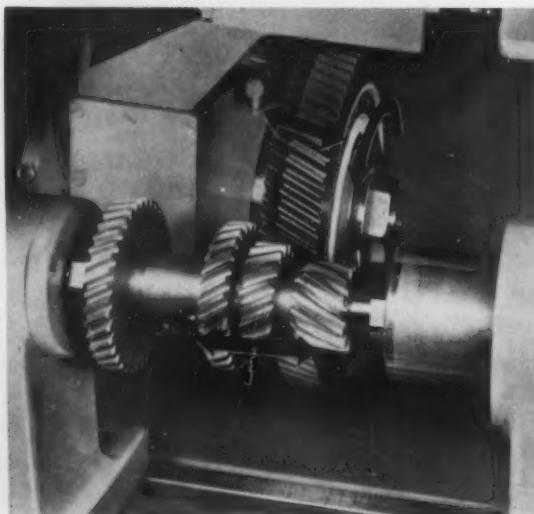


Fig. 1. (Left) Four motions of Michigan gear-finishing process impart true honing action. Arrows indicate three motions, the fourth being obtained by the crossed-axis relationship between hone and work-piece. Fig. 2. (Right) In this setup, a nontoothed (smooth) hone is being used to finish the outside diameter of a spline shaft

rated in a new version of the Michigan abrasive gear finisher and is available as standard on the new 999-A machines. In addition, a new head-modification kit is available to convert former models of Michigan abrasive gear finishers to the new process in the field.

For finishing gears, Fig. 1, the abrasive hone used is a gear-like tool made of special high-strength plastic impregnated with abrasive. It is rotated in tight mesh with the hardened work gear at crossed axis. The honing action on the gear teeth is achieved by combining four motions: an in-mesh rotation under controlled lead, a crossed-axis relationship between hone and work, a high-speed axial oscillation of the tool in a ratio of three oscillations per one revolution of the tool, and a reciprocating motion which traverses the work a preset amount across the

hone for the gear's full face width. Hone rotation is variable from 150 to 600 rpm, and table reciprocation can be independently varied, thus allowing high spindle speed and slow table reciprocation or vice versa. Tool-head angle is variable up to 25 degrees. Axial movement of the hone is approximately 1/16 inch. Fig. 2 shows a special setup for finishing the outside diameter of a spline shaft.

For narrow gears or shoulder gears, table reciprocation can be locked out, and the combination of rotation and axial oscillation will provide ample honing action. Pressure between work and cutter is positively controlled and adjustable to suit various conditions. A set of precision calibrated weights assures constant pressure and is supplied to enable easy and positive change in amount of tool pressure. In addition to finishing spur and helical gears, the ma-

chine is equipped with a standard crowning-taper attachment which will: either follow a preformed crown; produce, within limits, a small amount of crown or end relief; follow a preformed amount of taper; produce a small amount of taper; or a combination of crown and taper.

The 999-A machine is easily adaptable to full automation or to automatic loading. Manual loading is very simple. Optional equipment includes automatic loading device, crowning-taper attachment, internal gear-finishing head, and manual or automatic tool dresser. The Model 999-A machine, Fig. 1, will handle a wide variety of gears up to 12 inches in diameter and up to 5 inches in face width, and has a maximum distance between centers of 30 inches. Larger machines can also be furnished to order.

Circle 573 on Readers' Service Card

LeBlond Tool and Diemakers' Lathe

A dual-drive tool and diemakers' lathe with reversible-apron, single-lever selection of sixteen speeds from 31 to 2400 rpm, and built-in horsepower meter for its 5-hp motor, has been announced by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. The dual-drive headstock provides twelve gear-driven speeds for smooth power in the high range. The three-bearing spindle has "zero" precision Timken bearings. Lubrication is by automatic forced feed. The new electric clutch and brake provide smooth and positive stops and starts.

Reverse to the lead-screw and feed is controlled from the rigid one-piece apron. A single lever engages both cross and length feed through a positive-jaw clutch. A single trip for feeding and chasing in each direction (spindle forward only) is standard. Quick-set dials are provided for both cross-feed and compound rest.

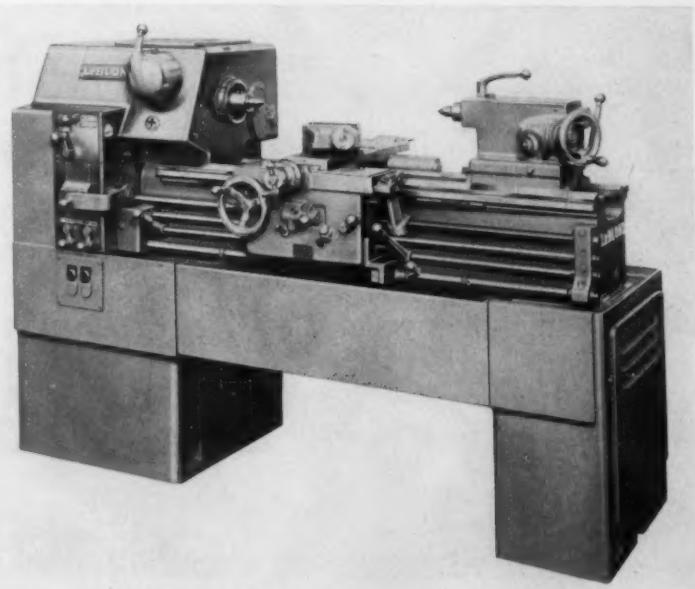
Forty-eight feed and thread changes are available through the totally enclosed quick-change box, which is lubricated automatically. A safety interlock prevents engagement of coarse feeds while in

the high-speed range. A dial at the end of the spindle provides a convenient means of indexing for chasing multiple threads.

The LeBlond thrust-lock tailstock has the handwheel located at a convenient angle and provides

full-length support to the spindle. A dial is provided for measuring spindle travel. Clamping is quick-acting. The heavy-duty bed has replaceable hardened and ground steel ways, fitted to compensating V-ways.

Circle 574 on Readers' Service Card



LeBlond dual-drive reversible-apron tool and diemakers' lathe

AMF Friction-Welding Machines Which Employ Heat Generated by Friction

The American Machine & Foundry Co., Niles, Ill., displayed for the first time, at the National Metal Show in Detroit, a production model of its revolutionary new type of welding machines. The friction-welding process applied by this machine consists of using heat generated by friction and pressure to produce the weld. Actually, the process makes use of three variables: pressure, speed of rotation, and time. In any given case, the specific values of these variables depend on the thermal and mechanical characteristics of the work-pieces, as well as on their size and shape.

The Model 15-4 machine shown in the illustration has a weld capacity of 1 3/4 square inches and a maximum axial thrust of 20,000 pounds. Another model, 75-A (not illustrated), has a weld capacity of 10 square inches and a maximum

axial thrust of 130,000 pounds.

These machines can be programmed easily into a production line, and are ruggedly built for heavy-duty service. With the machine set for the proper cycle, welds are readily reproduced, and highly skilled operators are not necessary. The cycle of Model 75-A includes automatic chucking and unchucking of the work-pieces. Because all the heat is generated where it is needed—at the contacting surfaces—these machines are extremely efficient: power consumption is said to be a fraction of that needed for flash, pressure, or induction welding.

Friction welding is a fast process, the welding cycles ranging from seven-tenths of a second to one minute. Designed for flexibility, these machines permit many variations in the welding cycle. Tests can be made quickly

and inexpensively, and results can be put into practice immediately.

The basic jobs done by the friction-welding process are the welding of the butt ends of bars or tubes, and the welding of bars or tubes to flat plates. The process is adaptable to a wide range of applications throughout the metal fabrication industry. These include welding parts such as: axle shafts, billet extensions, boiler tubes, brake camshafts, check valves, containers, extensions on drills and reamers, fence posts, high-pressure vessels, hollow ball bearings, hydraulic cylinder assemblies, pipe couplings and valve stems.

Satisfactory welds have been made with the following materials: low, medium, and high carbon steels; stainless steels; high-speed tool steels; alloy steels; aluminum and alloys; copper; brass; molybdenum; titanium; silver; plastics; zircaloy; bronze; cast iron; nickel and alloys; and cobalt alloys.

Circle 575 on Readers' Service Card



Friction-welding machine, Model 15-4, introduced at National Metal Show in Detroit by American Machine & Foundry Co.



CINCINNATI
Hydroform

Now,
7 Times
Faster!

New CINCINNATI
Hi-Production Hydroform



The NEW Cincinnati Hi-Production Hydroform is available in sizes to accommodate blanks of 8", 10", 12", 15", 20", 25", 30", and 40" diameter. A 12" machine is shown.

The part shown is a coffee pot body formed from a 12" dia. blank of .032" copper. It is formed in 1 draw in less than 6 seconds. Conventional method requires 5 draw operations and 2 anneals. Part depth is 6-13/16"; minimum dia. is 2-17/32".

The NEW Cincinnati Hi-Production Hydroform is the most advanced deep drawing machine in the metal forming field. For full details, contact a Meta-Dynamics Division application engineer or write for Catalog No. M-2193A.

New CINCINNATI Hi-Production Hydroform® has many advantages for deep draw work:

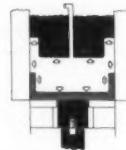
- Operating rates range from 600 to 1800 cycles per hour. Production rate is proportional to depth of part. Traverse speeds are fast. Draw speeds are well below the critical draw speed for any material.
 - Complex parts are drawn in fewer operations.
 - Improved part surface finish reduces finishing costs.
 - Many hard-to-draw materials can be formed successfully.
 - Tool costs are extremely low, as compared to conventional die sets.
 - Tools can be changed in 5 to 10 minutes.
 - Cuts material costs by minimizing thin-out. Thickness of the blank can often be reduced.
 - Double blanks will not damage tooling or machine.
- ★ ★ ★

Cincinnati Hydroform can also be used as a high tonnage conventional press for coining, cold extrusion, or other jobs requiring high unit forming pressure.

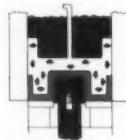
Cincinnati Hydroform unique deep drawing principle is shown below.



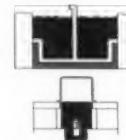
1. Blank is placed on blankholder.



2. Forming chamber is lowered and initial pressure applied.



3. Punch moves upward into flexible die member.



4. Pressure is released, forming chamber raised, and punch is stripped from finished part.

META-DYNAMICS DIVISION

Center of Chipless Machining
Hydroform • Intraform • Hydrospin



THE CINCINNATI MILLING MACHINE CO.

MACHINERY'S DATA SHEET

SPRING DESIGN DATA—9

Glossary of Spring Terms (See Data Sheets in July, August, September, and October, 1961, MACHINERY)

ACTIVE COILS are those coils which are free to deflect when a load is applied to the spring. In most extension springs, all the coils are active. There is a definite difference between active coils and total coils in compression springs.

ANGULAR RELATIONSHIP OF HOOKS applies to extension springs, and refers to the relative position of the hooks to each other. Since the angular relationship varies in the manufacture of springs, it is recommended that a tolerance be placed on this specification, unless the hooks may vary at random.

BLUE—See "Stress Relief."

BODY LENGTH refers to the over-all length of the active coils in an extension spring. Does not apply to compression springs.

CLOSED ENDS—See "Squared Ends, Not Ground."

CLOSED LENGTH (HEIGHT)—See "Solid Height."

COILING is the forming of wire into a spring on an automatic coiling machine.

DRAW—See "Temper."

ELASTICITY refers to the ability of a material to return to its original form after having been extended, compressed, bent, or twisted.

ELASTIC LIMIT is the maximum stress to which a material may be safely subjected. Higher stresses would produce permanent set.

ENDURANCE LIMIT is the maximum stress at which any given material will operate indefinitely without failure. This stress varies with the working stress range.

FATIGUE is a type of failure which results in breakage when springs are operated repeatedly at a stress in excess of the endurance limit. This may occur at a stress below the elastic limit of the material.

FINAL LOAD in a compression spring refers to the load at the shortest length the spring must operate. In an extension spring, it refers to the load at the longest length at which the spring is required to operate. (As opposed to "initial load.")

FINAL TORQUE in a torsion spring is the torque at the largest deflection angle of the arms at which the spring must operate.

FREE ANGLE is the angle between the arms of a torsion spring when the spring is not loaded.

FREE LENGTH is the length of a spring without load. This length is the overall length of a compression spring or the length measured inside the hooks at the ends of extension springs.

FREQUENCY (IMPRESSIVE) is the rate of external load application in cycles per second.

FREQUENCY (NATURAL) is the inherent rate of free vibration of a spring itself in cycles per second.

GRADIENT is the load required to deflect a spring a given distance. Gradient is usually specified in pounds per inch. This factor is also known as "rate," "scale," "load factor" and "spring constant."

HARDENING of spring materials is usually accomplished by heat treating. The word usually implies that the material is heated to a temperature above the critical point and quenched in oil or water.

INDEX is the ratio of mean diameter to wire diameter (D/d).

INITIAL LOAD in a compression spring refers to the load at the longest length the spring must operate. In an extension spring, it refers to the load at the shortest length the spring is required to operate. (As opposed to "final load.")

INITIAL TENSION in an extension spring refers to the "pre-load" which has been wound into the coils of a spring during the coiling operation and which must be overcome before the coils will start to open.

INITIAL TORQUE in a torsion spring is the torque at the smallest deflection angle of the arms at which the spring must operate.

MANUFACTURING VARIATION is the inherent process variation experienced in manufacturing. This is independent of a specified tolerance.

MODULUS OF MATERIAL is a measurable coefficient which expresses the stiffness of a material. The modulus of most materials does not vary appreciably with the hardness or temper.

MODULUS IN SHEAR (G) is the measurable coefficient of the stiffness of a material deformed by twisting.

MODULUS IN TENSION (E) is the measurable coefficient of the stiffness of a material deformed by extending, compressing, or bending.

MOMENT is a twisting action which tends to produce rotation. It is usually expressed in lbs.-ft. or in lbs.-inches.

OPENING OF HOOKS is the space between the end of the wire and the body of a spring. It is sometimes necessary for assembly purposes.

OPERATING DEFLECTION refers to the motion of the spring between operating lengths in the application.

PERMANENT SET takes place when a material is deformed so far that its elastic properties have been exceeded. When this is the case, a spring does not return to its original dimension upon release of the load.

PITCH is the distance from center to center of adjacent coils in a spring. This specification applies to the spring in its free position, and is sometimes known as "lead" or is inversely specified as "coils per inch."

PLAIN ENDS is a description of the end finish of a compression spring when there is constant pitch for all its coils. This type of end is sometimes called "open ends" and can be either ground or not ground.

PRESS—See "Remove Set."

PRIMARY LOAD is the term used to describe the important load requirement for a spring. (Can be initial or final load depending upon the application.)

REMOVE SET is an operation applied to compression springs. This operation apparently increases the elastic limit of the material by inducing favorable residual stresses. The springs are coiled longer than desired so that the length will be correct after the set is removed. Each spring must be compressed solid, coil to coil, in order to remove the set. The operation is sometimes known as "pressing," "setting" or "cold setting."

RESIDUAL STRESS is induced in a material when it is deformed or permanently set.

SCALE—See "Gradient."

SECONDARY LOAD is a term which refers to the less important of two load requirements in a spring. (Can be initial or final load depending upon the application.)

SET—See "Remove Set."

SOLID HEIGHT is the length of a compression spring when a sufficient load has been applied to bring all coils in contact with the adjacent coils and additional load causes no further deflection. This is sometimes known as "solid length" or "closed height."

SQUARED AND GROUND ENDS is a term used to specify ends of a compression spring where the pitch of the last coil is reduced to square off the end as much as possible after which the ends are ground to produce a flat seat. This is also known as "squared ends ground" or "closed ends ground."

SQUARED ENDS, NOT GROUND is a term used to specify ends of compression springs where the pitch of the last coil is reduced to square off the end as much as possible without grinding. This is also known as "squared ends," "closed ends," and "closed ends not ground."

STRESS is the intensity of force per unit area which produces an internal force equal to and opposite in direction to the external load on the spring. When a spring at rest supports a load, this internal force resists further deflection under the load. Stress is expressed in pounds per square inch.

STRESS RANGE is the difference in operating stresses at maximum and minimum load.

STRESS RELIEF is a low temperature heat treatment performed after coiling to remove undesirable residual stresses induced in the wire during the coiling operation. Compression and extension springs should be stress relieved to avoid an apparent reduction in the elastic limit due to these coiling strains. On the other hand, torsion springs and some spring rings should not be stress relieved, because the residual coiling stresses tend to increase the apparent elastic limit for these springs. This operation is sometimes called "bluing," and, incorrectly, "drawing" or "tempering."

TEMPER is the heat treating of hardened steel below the critical temperature to reduce hardness and, therefore, brittleness and to thus improve its spring properties.

TOLERANCE is a permissible variation for a given specification. In establishing the tolerance for a specification, the manufacturing variation should be considered. Greater accuracy than indicated by the manufacturing variation can only be obtained by additional manufacturing or inspection operations adding to the cost of the springs.

TORQUE—See "Moment."

TOTAL COILS is the total number of coils in the spring, as the name implies. The term is used for compression springs only, and need not be used if the active coils are specified.

WINDING is the forming of wire into a helix by wrapping it around an arbor.

WIRE GAUGE is a specification for the size of the wire to be used but is only identifiable when the table is also given. The proper procedure is for the designer to select the desired size from the appropriate wire gauge table for the material and then to specify only the decimal size indicated.

Courtesy of Hunter Spring Co., a division of American Machine & Metals, Inc., Lansdale, Pa.

MACHINERY'S DATA SHEET

SPRING DESIGN DATA—10

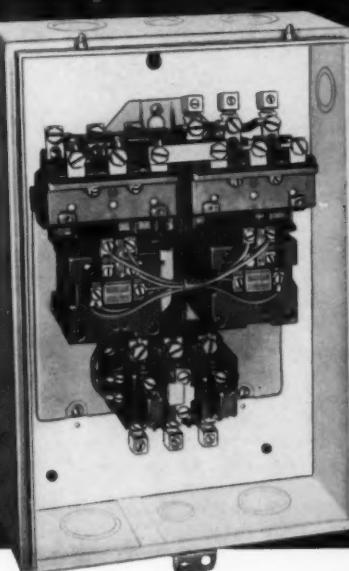
Symbols Used in Design Data Sheets Published in July,
August, September, and October, 1961, MACHINERY)

<i>d</i>	wire diameter (or outside diameter of tubing)	in.	<i>P</i> ₁	initial load	lb
<i>f</i>	deflection per active coil	in. per coil	<i>P</i> ₂	final load	lb
<i>h</i>	solid height (compression spring) or body length (extension spring)	in.	<i>P</i> ₃	load at maximum stress without set	lb
<i>l</i>	length of torsion spring arms (<i>l</i> ₁ and <i>l</i> ₂)		<i>R</i> ₁	stress concentration factor (in shear) for round wire	
<i>A</i>	correction factor of stress range, life cycles and spring material		<i>R</i> ₂	stress concentration factor (in bending) for round wire	
<i>A</i> _t	a factor adjuster for use at elevated temperatures		<i>R</i> ₃	stress concentration factor (in shear) for square wire	
<i>C</i>	correction to <i>N</i> for solid height calculation	coils	<i>R</i> ₄	stress concentration factor (in bending) for square wire	
<i>D</i>	mean coil diameter (OD- <i>d</i>)	in.	<i>S</i> _r	stress ratio $\left(\frac{S_2-S_1}{S_2}\right)$	
<i>D/d</i>	spring index		<i>S</i>	basic stress	psi
<i>E</i>	Young's Modulus of Elasticity	psi	<i>S</i> ₁	initial stress	psi
<i>F</i>	deflection or spring motion (between operating lengths)	in.	<i>S</i> ₂	final stress	psi
<i>G</i>	torsional modulus	psi	<i>S</i> _s	shearing stress	psi
<i>H</i>	free length (for extension springs include hooks to point of contact with other members)	in.	<i>S</i> _b	bending stress	psi
<i>ID</i>	inside diameter	in.	<i>S</i> _s max	maximum solid stress	psi
<i>K</i>	gradient	lb. per in. or lb.-in. per deg	<i>S</i> _y	maximum apparent yield point	psi
<i>L</i> ₁	length at initial load	in.	<i>S</i> _{y1}	maximum apparent yield point at elevated temperatures	psi
<i>L</i> ₂	length at final load	in.	<i>U</i>	correction factor for torsional shear modulus	
<i>L</i> ₃	maximum permissible extended length (based on <i>P</i> ₃)	in.	<i>T</i>	thickness of plating	in.
<i>M</i>	torque (or moment)	lb-in.	<i>θ</i> ₁	initial angle between arms of torsion spring	deg
<i>M</i> ₁	initial torque of torsion spring	lb-in.	<i>θ</i> ₂	final angle between arms of torsion spring	deg
<i>M</i> ₂	final torque of torsion spring	lb-in.	<i>θ</i> _f	free angle between arms of torsion spring	deg
<i>N</i>	number of active coils	coils	<i>ϕ</i> ₁	initial angular deflection	deg
<i>N</i> _t	number coils to be wound	coils	<i>ϕ</i> ₂	final angular deflection	deg
<i>N/H</i> or <i>N/h</i>	pitch (for compression or extension springs, respectively)	coils per in.	Δ <i>H</i>	variation in free length	in.
<i>OD</i>	outside diameter	in.	Δ <i>K</i>	variation in gradient	lb. per in. or lb.-in. per deg
<i>P</i>	load	lb	Δ <i>P</i> ₁	variation in initial load	lb
<i>P</i> ₁	initial tension	lb	Δ <i>P</i> ₂	variation in final load	lb
<i>P</i> ₁	corrected load for use with Spring Tables	lb	Δ <i>P</i> _i	variation in initial tension	lb
			Δ <i>I</i>	initial tension variation factor	in. per in.

Courtesy of Hunter Spring Co., a division of American Machine & Metals, Inc., Lansdale, Pa.



How's this for SATISFYING YOUR REVERSING SWITCH PROBLEMS!



BULLETIN 705 SIZE 2 Reversing Starters—Available in Seven Sizes with Maximum Ratings up to 100 HP, 220 V; 200 HP, 440-550 V.

Open or Enclosed—THEY SAVE SPACE WHERE IT COUNTS MOST

Listen to this—all new "open type" A-B reversing switches have the overload relays mounted at the sides as shown—ideal construction for panel channel wiring. It fits with A-B contactors and starters of the same rating. The over-all width for each rating is also appreciably less than it was with the old Bulletin 705.

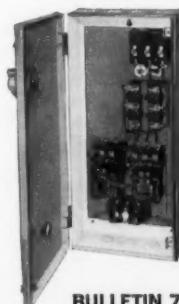
All new enclosed A-B reversing switches have the overload relays (either 2 or 3) mounted as a "block" below the reversing switch. This permits a narrow enclosure—ideal for most mountings on machine tools.

Rating for rating, the new Allen-Bradley reversing starters will set new records for

long, trouble-free life. The new structure is so simple and so sturdy that nothing can go wrong. If you have a particularly tough service application, try the new A-B Series K reversing switches—and live happily ever after.

You'll like the new line of modern, attractive enclosures, too. Brooks Stevens, internationally known industrial designer, has given them that extra "eye appeal"—which is an asset for every installation.

For complete information on these new reversing switches, please write today for Publication 6100, Allen-Bradley Co., 1316 S. Second Street, Milwaukee 4, Wisconsin.



BULLETIN 706
Size 1 Combination Reversing Starter—available with fused or unfused manual disconnect switch, or as Bulletin 707 with circuit breaker.

17-61-MR

ALLEN-BRADLEY

Member of NEMA

**QUALITY
MOTOR CONTROL**

The Superior "Quality" of the New Allen-Bradley Starters GREW OUT OF DESTRUCTIVE TESTS

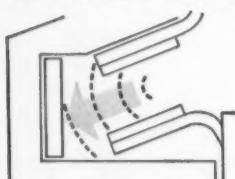
Tests which subject starters to far more severe conditions than heavy-duty service are "routine" at Allen-Bradley and provide data for improved starter design

There was no question about the "quality" of the old Bulletin 709 starters but—the new line is far superior. With their built-in "extra" interrupting capacity, each rating of the revolutionary new Allen-Bradley motor starters can operate with ease at maximum rated capacity for prolonged periods—and still have more than ample reserve for emergency conditions. The new, totally enclosed arc hoods are hot molded of a material having unusual arc quenching properties. In addition, powerful arc blowouts and wrap-around metal quenchers assure fast, efficient arc extinction and heat dissipation. There are many other features about this new line that you ought to know. Therefore, please write for Bulletin 6100, today! Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.



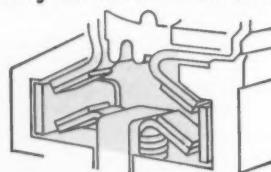
Here's How EXTRA Interrupting Capacity Is Built Into All Allen-Bradley Starters

Powerful Arc Blowout



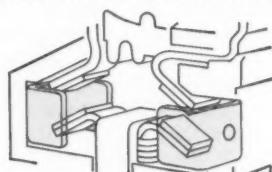
The powerful magnetic field, generated between the contacts when an arc is drawn, forces the arc off the end of the contacts. It is quickly cooled and extinguished by the large surfaces of the hood.

Totally Enclosed Chambers



A new, unusually strong and stable material is hot molded to extremely close tolerances. Each chamber of the arc hood is totally enclosed. Thus, the usual effects of ionization and heat are greatly minimized.

Metal Arc Quenchers

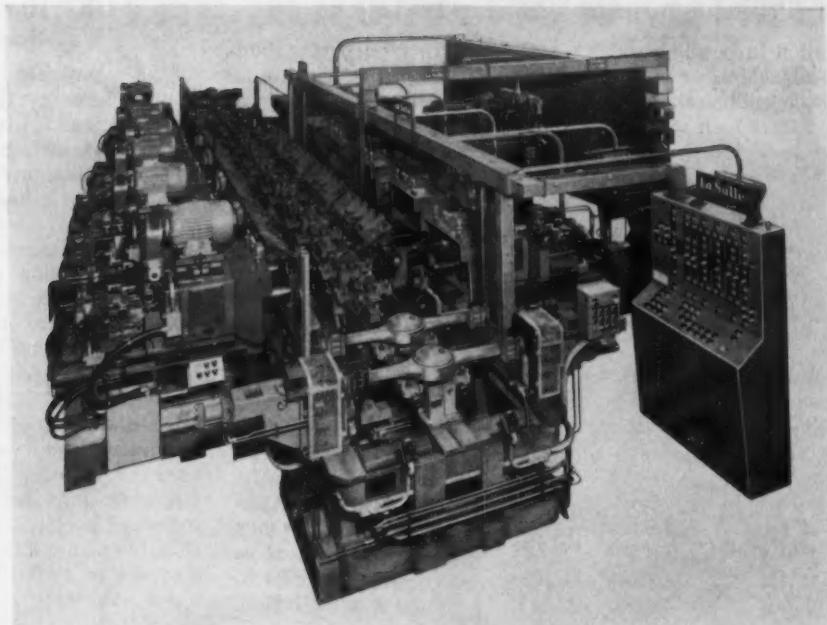


Size 2 starters and the higher ratings have metal quenchers in both the front and back of each arc chamber. This efficient construction gives the arc no chance to become destructive.

17-61-MR

ALLEN-BRADLEY

QUALITY
MOTOR CONTROL



LaSalle transfer machine equipped for processing rear axle housings

Nine-Station Transfer Type Machine for Processing Rear Axle Housings

LaSalle Machine Tool, Inc., Warren, Mich., has recently built a nine-station in-line transfer type machine for processing rear axle-housing assemblies in multiples of two. This machine is built entirely from LaSalle building-block machine components. The machine base assembly consists of two center base sections, fabricated of steel plate suitably ribbed for rigidity, and thoroughly normalized to maintain stability in operation, and twelve LaSalle standard 18-inch way type floor-mounted units.

The hydraulic and electrical equipment conforms to JIC standards, and is arranged for 400-volt, 3-phase, 60-cycle alternating current. The transfer mechanism is of the walking-beam type. It is hydraulically actuated and electrically controlled. The work-load rail assembly is at Station No. 1.

At this station, one part is located in position A, qualified for proper length, and then automatically transferred to position B. A second part is then loaded, qualified, and transferred to position B. Both parts are then automatically transferred simultaneously to Sta-

tion No. 2 (and continue as a pair from station to station).

At Station No. 2, the outside diameter of the flange is turned and both the front and rear of the flange are chamfered. At the third station, the bearing diameter is rough-bored, the oil-seal diameter is roughed, the pilot diameter is rough-turned, and the flange undercut. The outside diameter of the pilot is chamfered, the flange is faced, the pilot is faced to length, the bearing is faced to depth, and the oil seal is faced to depth. These last three operations are performed by the cross-feed.

At Station No. 4, semifinishing operations are performed on the bearing bore diameter and the oil seal. The pilot diameter is finish-turned, the flange finish-faced, the pilot finish-faced to length, the face bearing finished to depth, and the oil seal faced to depth. These last four operations are done by the cross-feed.

Semifinish-reaming and chamfering the bearing diameter, chamfering the oil-seal diameter, and finish-reaming the oil-seal diameter are the operations performed at the fifth station. At Sta-

tion No. 6, the four flange holes are combination drilled and reamed. Station No. 7, (designed for future use) remains idle. Finish reaming of the bearing diameters is done at the eighth station. At Station No. 9, the two parts are automatically unloaded.

Circle 576 on Readers' Service Card

Omnitronics Bidirectional Photoelectric Tape Reader

A bidirectional photoelectric tape reader, Model PTR-71, that incorporates the same application of chopped reflected light previously developed by Omnitronics, Inc., Philadelphia, Pa., a Borg-Warner subsidiary, has been announced by this company. The unique bidirectional drive enables instantaneous tape reversal to be accomplished by using a unidirectional synchronous speed motor. Two capstans are driven in opposite directions continuously, with respective solenoid-actuated pinch rollers determining the direction of tape travel. It is adapted for tape reading applications such as input to digital computers, communication systems, tape converters, ground support equipment, checkout equipment and numerical machine tool control.

Circle 577 on Readers' Service Card

Precision Adjustable Boring Tools

An innovation in boring cutter technology—adjustability with a graduated scale calibrated in increments of 0.0001 inch within a range of up to 1/4 inch—is announced by the Wesson Corporation, Ferndale, Mich. The precision adjustment ring incorporating the calibrated scale is available in both standard and special Wesson boring tools. Shown here are four styles of the new bars. From left to right, these are:

(1) A boring-bar with two independent adjustments. One is coarse to adjust diameter in increments of 0.001 inch. The second is superprecision for setting to 0.0001 inch. Total on the coarse adjustment is 0.250 inch on diameter and fine-adjustment range is 0.004 inch. Nominal hole-size variation is from 1/8 to 1/2 inch, obtained by the use of interchangeable heads.

(2) A superprecision boring-bar with total adjustment range of 0.004 inch in 0.0001-inch increments. This is primarily for production jobs where the same hole size is to be bored to close tolerance over long runs or repeated shorter runs.

(3) A boring-bar for superprecision boring of any size in any kind of machine whether the bar is on the center line of the part or not. Adjustable in increments of 0.0001 inch over a range of 0.008 inch. Interchangeable heads permit use of this tool for hole sizes ranging from 1/2 inch up.

(4) A fourth type having both coarse and fine adjustment (same as No. 1) but using throw-away inserts. Size variation, by use of interchangeable heads, is 1/2 to 3 inches. Lead angle, rake angle, and insert style are variable.

Circle 578 on Readers' Service Card

Portable and Semiportable Conveyor for Metal Parts and Products

A complete line of fully portable and semiportable conveyors with adjustable height has been developed by the May-Fran Mfg. Co., a division of Fischer & Associates, Inc., Cleveland, Ohio. These conveyors can be used as auxiliary or independent units to feed or discharge a wide variety of products.

The Series "A" Little Hustler conveyor, which is fully portable, features pitch adjustment of the charge and discharge ends to any angle from horizontal to a 45-degree incline. The Series "S" Little Hustler is a semiportable conveyor designed with telescopic legs for raising or lowering the discharge end.

Both Series "A" and "S" Little Hustler conveyors are available with neoprene-impregnated fabric belts for general-purpose use, or May-Fran hinged-steel belting for handling hot or highly abrasive materials.

Circle 579 on Readers' Service Card

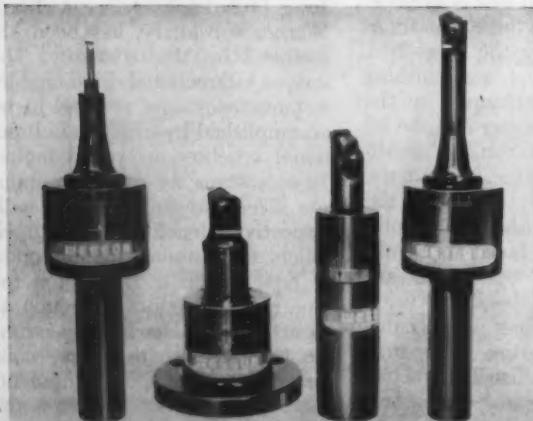
"OK" Hardened Way Sections

"OK" hardened way sections, manufactured by the Ohio Knife Co., Cincinnati, Ohio, are said to permit large savings on initial cost and on installation for users in the metalworking industry. Initial cost savings are accomplished by means of the manufacturer's special "OK Cladding" process, which makes it possible to restrict expensive hardening to only those areas of the way section where it is required. In this process, tool steel hardened to 64-66 Rockwell C is bonded to a soft-steel backing.

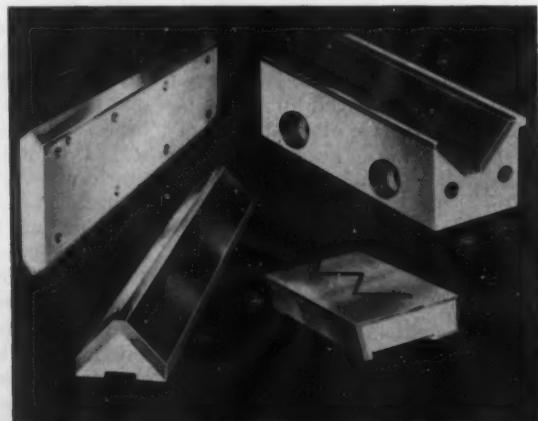
The hardened ways are delivered ready to be installed. Installation is simplified because the soft-steel backing is readily machinable, and can be quickly doweled or drilled as necessary. Since the ways are bolted in place, they can be easily replaced or refinished. It is not necessary to return the bed or replace it. New strips can be furnished for existing equipment, or old ones reground.

OK hardened ways are carried in stock in all practical widths and in lengths up to 168 inches. Twelve different cross sections in eighty-eight sizes are available. Applications include use as standard hardened ways and slides, composite die sections, heel blocks, and flange slides. A complete line of long-wearing clad-bronze ways and wear plates are also available.

Circle 580 on Readers' Service Card



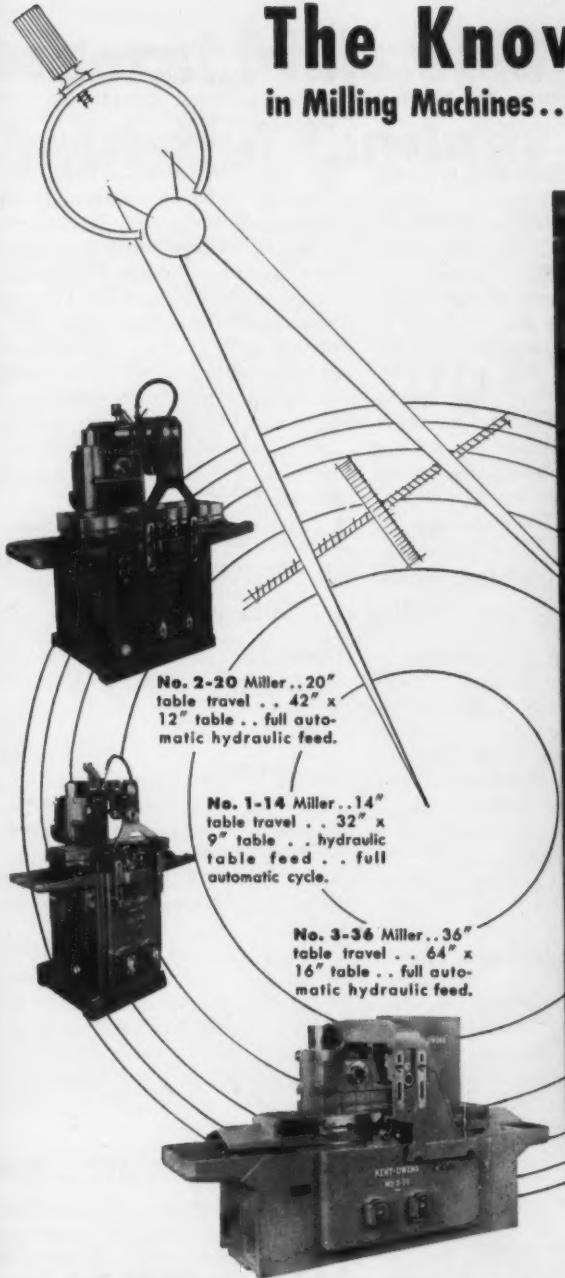
Wesson boring-bars equipped for precision adjustment



Hardened machine ways announced by Ohio Knife Co.

The Know-How Dimension

in Milling Machines . . Special Machinery . . Automation Equipment



A section of our assembly floor showing Automation-Type Machines in process of manufacture.

.. makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for answers to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to

other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS

Designers and Builders of
Milling Machines and Special Machinery

Two-Axis Control Cabinet with Positioning Table

An MT-4 two-axis control system with integrated positioning table has been brought out by the Hughes Industrial Systems Division, Hughes Aircraft Co., Los Angeles, Calif. The positioning system comprises a numerical-control unit housed in a compact metal cabinet and a positioning table. This MT-4 system is adaptable to practically any kind of drilling machine, single- or multiple-spindle, or to any type of machine that requires two-axis positioning as provided by numerical control. The availability of the positioning table shown in the illustration greatly facilitates conversion of machines with fixed tables to numerically controlled operation. The control system is designed to reduce lead time, eliminate complex jigs and expensive tooling, and increase production.

Sensitive photoelectric tape reader eliminates deformation of tape holes, reduces tape wear and tear, and assures accuracy. Changing the tape for a new part requires only thirty seconds. The system employs the NC200 series numerical control, which is fully transistorized and completely digital. It does not depend on analog measuring techniques. A two-speed drive unit, in combination with the positioning control used, gives repeatable accuracies of 0.0005 inch with a resolution of 0.001 inch. This same combination provides extremely fast positioning. The table can move 1 inch

in less than one second and requires no settling time, i.e., time required to position the last few thousandths of an inch.

The Hughes positioning table shown in the illustration is a self-contained unit designed for operation with the Hughes NC200 numerical control. Positioning drive motors and feedback transducers are integral parts of the table. Dovetailed ways are employed so that the system may be used for milling work as well as positioning. Special milling feed motors are available. Positioning movement is accomplished by driving precision recirculating ball screws with the Hughes "traverse creep" drive system. The accuracy of

movement is governed by completely reliable photoelectric transducers installed directly on the lead-screws.

Top-grade Meehanite castings are used in table construction. They are precision-machined and assembled to provide accuracies of 0.0005 inch per foot in squareness, and parallelism. Equipment supplied includes: one Hughes two-axis numerical control self-contained in metal cabinet, one Hughes positioning table complete with drive units and feedback transducers, necessary cables and accessories, and instruction manual. The table is 38 by 22 inches.

Circle 581 on Readers' Service Card

Multiple-Purpose Self-Centering Jig for Drilling and Milling

A "Mult-A-Jig" designed for use in a wide range of drilling and milling work has been announced by the American Drill Bushing Co., Los Angeles, Calif. This jig automatically centers round or square stock for milling or drilling. It can be mounted either vertically or horizontally on a drill press, milling machine, or the faceplate of a lathe. Typical uses include cutting keyways, straddle milling, or slotting, and eccentric turning and drilling. An adjustable stop is furnished for controlling the exact distance of the drilled hole from the end of stock.

Every jig is equipped with three jig-plate brackets fully machined from heavy one-piece castings and with lock screws and Type "L"

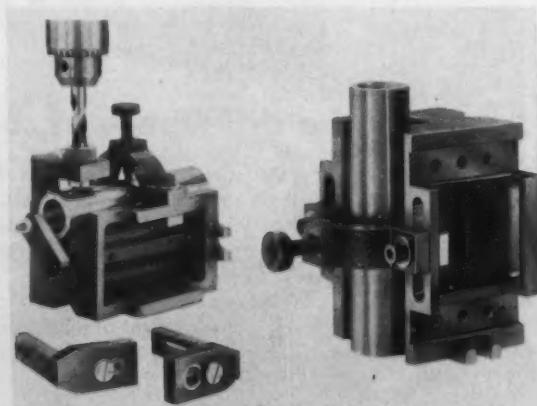
liners. The liners have inside diameters of 5/16, 1/2, and 3/4 inch to accommodate American slip renewable or fixed renewable type bushings in sizes of No. 80 through 9/16-inch inside diameter. These bushings, sold separately, may be inserted for the individual hole size required. Brackets are reversible and may be used together for drilling different-size holes at various lengths.

The Mult-A-Jig is 3 by 3 by 5 inches and holds 1/4- to 1-inch round stock on one side and 1- to 1 5/8-inch stock on the other. It is furnished with three bushing brackets equipped with liners and lock screws, adjustable stop, and clamp frame.

Circle 582 on Readers' Service Card



Hughes positioning table operated by two-axis control



Mult-A-Jig introduced by American Drill Bushing Co.

General Mills said it about the Lindner Optical Jig Borer

"Machine time on the Lindner was 32 hours. Estimated time on any other machine or combination of machines in the shop was at least 64 hours, with serious doubts that the quality would have been as good."

The Job:

Machining an optical test fixture for checking the hemisphere sight for the MD-9 Tail Defense System, used in the B-52 Bomber.

The Specs:

- 1) Locating and boring bearing holes to $\pm .0002$, $-.0000$;
- 2) Locating and boring 49 additional holes for mounting optical lenses;
- 3) Milling a flat surface with first class microfinish around each hole to an angular position within ± 2 minutes.

The Machine:

Lindner Optical Jig Borer, Model LB15A, with preselective Autopositioner®, used throughout for all locating and machining.

need we say more?

Learn why Lindner Optical Jig Borers have changed so many ideas about jig boring. Send for a 25-minute movie film demonstration without obligation.

Lindner Optical Jig Borers are available in two models: LB15A with Autopositioner—Table size 44" x 24"; LB14—32" x 16" (without Autopositioner)



KURT ORBAN

COMPANY, INC.

1259 U. S. Route 46, Parsippany, New Jersey

Cylinder-Boring Machine Also Finishes Crankshaft Thrust Faces

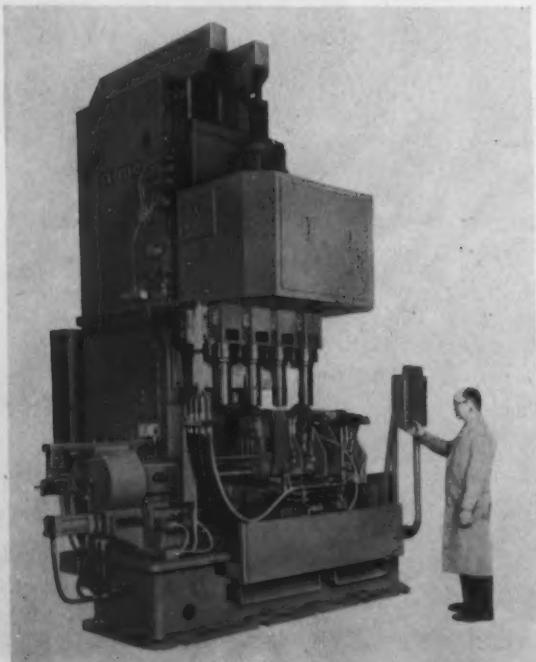
A custom precision vertical cylinder-boring machine having a horizontal slide for finish-facing the crankshaft thrust faces has been supplied to an engine manufacturer by the Ex-Cell-O Corporation, Detroit, Mich. This two-way vertical cylinder borer performs the facing and cylinder-boring operations simultaneously. An engine block is manually loaded from a conveyor at the right-hand side of the machine and is pushed against positive stops. As the operator presses the hydraulic clamp button, the elevator lowers, locating pins enter the part, and it is clamped.

The cycle commences as the fixture rapid-traverses to the left. This causes the block to move over the horizontal boring-bar and also to become positioned relative to the vertical boring quills. The vertical slide rapid-traverses downward and the fixture slide is clamped. Cylinder boring commences on alternate holes, while on the horizontal slide, the thrust-face facing tools are fed hydraulically outward from their rotat-

ing boring-bar. This bar is piloted on needle bearings in two previously finished crankshaft bearing holes. As the vertical cylinder-boring quills with micro-adjust tools reach the end of their stroke, a chamfering operation is performed within the cylinder bores by using a hydraulically fed form tool operated from within the boring quills. An individual stop on each spindle assures a close tolerance on the depth of the counterbore at the top of the cylinder bores.

When the boring quills have returned to their start position, the fixture indexes and the remaining cylinder bores are similarly machined. A metered air blast is used during the actual machining operations to clear chips from the tools and surfaces being machined. An air blast also clears chips from rest pads prior to loading, and a pressure switch will render the machine inoperative should chips become lodged between the rest pads and the work.

Circle 583 on Readers' Service Card



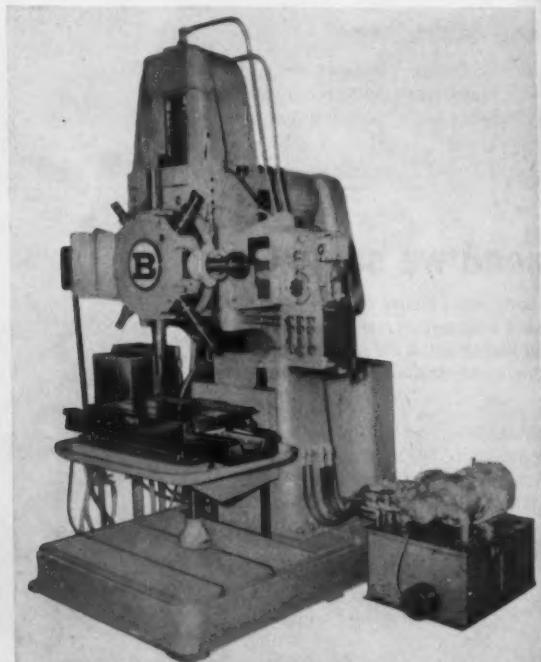
Ex-Cell-O custom-built machine that finish-bores cylinders and finish-faces thrust surfaces simultaneously

Indexing Slide-Table "Package"

Automatic multiple work positioning in any desired cycles can readily be provided on both standard and special machine tools by means of an indexing slide-table "package" announced by Russell T. Gilman, Inc., Grafton, Wis. This self-contained equipment includes: heavy-duty slide table with hardened steel ways and T-slots, multiple-station indexing mechanism with replaceable index control bar, portable electrohydraulic power pack with reservoir, and automatic-manual remote-control station that can be mounted at any convenient point.

The slide table can be used either as built-in original equipment on a special machine tool, or as a productive attachment for standard turret type drilling machines, multiple-spindle drilling machines, upright drills, boring machines, and others where the tooling feeds into the work. With a controlled feed rate, the slide can also be used to advantage for certain types of milling and slotting operations.

Circle 584 on Readers' Service Card



Gilman multiple-position indexing slide-table package used as attachment on turret type drilling machine

Snyder Corporation Applies Numerical Control to Dial Type Multi-Unit Machine



This new Snyder machine drills, reams and counterbores a wide variety of cast iron diesel fly-wheels by use of numerical controls. Fifteen different fly-wheels from 12½ inch to 20 inch diameter are processed with various control tapes. The wheel shown in the right foreground is unprocessed. Others are as they come from the machine, ready for assembly.

For the application illustrated, the machine

has one vertical, one angular and two horizontal standard units which are mounted around a 34 inch diameter table indexing at 2 rpm while maintaining an indexing spacing accuracy of plus or minus 0.0005 inches on a 32 inch diameter.

This type of machine is equally adaptable to a wide variety of other low production metal cutting work and its versatility, accuracy and economy suggest many profitable applications.

Movies of the machine in action are available.

We'll be glad to show them at your convenience. Just phone or write.

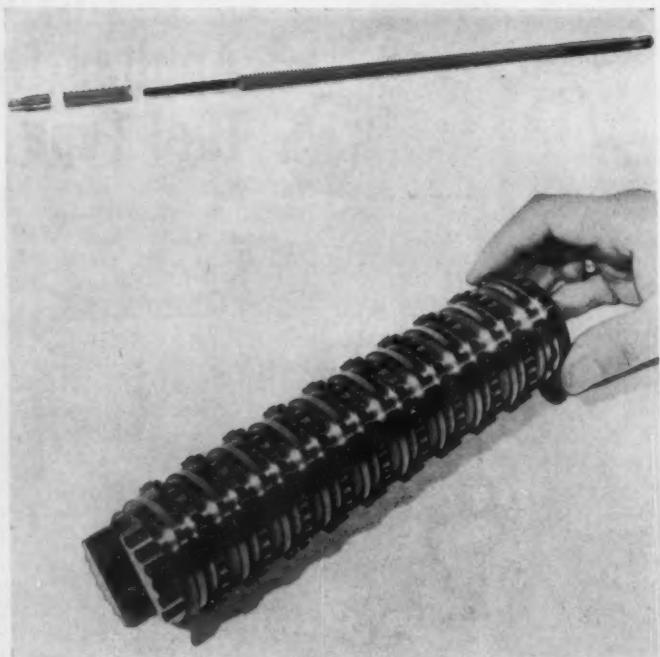
SNYDER
C O R P O R A T I O N
3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

Red Ring Broach for Internal Gears or Splines

A Red Ring broach designed to assure precision concentricity relationship between the inside diameter and the pitch diameter of internal gears or splines has been developed by the National Broach & Machine Co., Detroit, Mich. Called the Red Ring Concentricity Broach (patents pending), this tool is made up of a roughing broach with a removable finishing shell on the end of the broach. The finishing shell has alternate round and spline finishing sections, as shown in the enlarged lower view of the illustration. The disassembled broach shown in the upper view broaches a twenty-six-tooth, 12/24-diametral-pitch, 30-degree pressure angle, 2.1667-inch pitch-diameter internal spline in a truck transmission forging before any turning or gear production operations are performed. The broach is 80 inches long over-all.

The teeth on the shell are full involute form and apply the principles of "Full-Form Finishing." The round sections that finish the inside diameter of the teeth are also full circle and are precision-ground by the manufacturer in precision relationship to the teeth.

The new concentricity broach shaves the tooth profiles to proper form and size while the inside di-



(Top) Red Ring concentricity broach, 80 inches long, for broaching twenty-six-tooth internal spline. (Bottom) Enlarged finishing shell of broach shown above

ameter of the part is being broached to size. This simultaneous cutting action avoids production problems encountered with conventional one-piece spline broaches. The concentricity broaches are made to suit specific parts having splined holes or in-

ternal gears ranging up to 12 inches in pitch diameter. They are made of high-speed steel and given the Red Ring Naloy surface treatment to provide long wear life. A finishing shell will outwear several roughing broaches.

Circle 585 on Readers' Service Card



Press equipped with Bliss swing-out portable feed

"Swing-Out" Portable Feed for Press

A new "swing-out" portable feed which makes a press easily adaptable to either single-stroke or continuous operation is being offered by the E. W. Bliss Co., Press Division, Hastings, Mich. Available on new presses only, it can be used as a conventional single roll feed for continuous feeding or, by simply removing two bolts, it can be swung away from its normal position to permit single-trip hand feeding.

Further versatility is afforded by the adaptability of one feed to a number of presses of the same or different tonnages. Each press must be equipped with special mounting pads, pivot bracket, and

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GUARANTEE
ON THE
NEW
PRATT & WHITNEY
TAPE-O-MATIC DRILL

\$8,595

1½ HP. Big 30"x 20" table.
Simultaneous positioning of both axes.
(3 HP. optional at extra cost.)



NOW! FOR THE FIRST TIME A NUMERICALLY CONTROLLED DRILL FOR ONLY \$8,595
GUARANTEED TO REDUCE YOUR DRILLING COSTS

At last . . . a drill with the finest, transistorized, numerical-control system available for only \$8,595 . . . because P&W brings mass production to the machine tool industry for the first time . . . yet maintains the 100-year tradition of P&W quality.

The TAPE-O-MATIC enables **you** to benefit from numerical control . . . to gain a vitally-needed, important competitive edge.

WE BELIEVE IN THIS NEW DRILL SO STRONGLY THAT WE OFFER:

- 1 90-DAY, MONEY-BACK GUARANTEE. If by 90 days after purchase, this drill has not reduced your drilling costs, return it for refund, less transportation costs.
- 2 5-YEAR WARRANTY. We fully warrant the

TAPE-O-MATIC drill against defective parts and workmanship for 5 years from date of purchase.

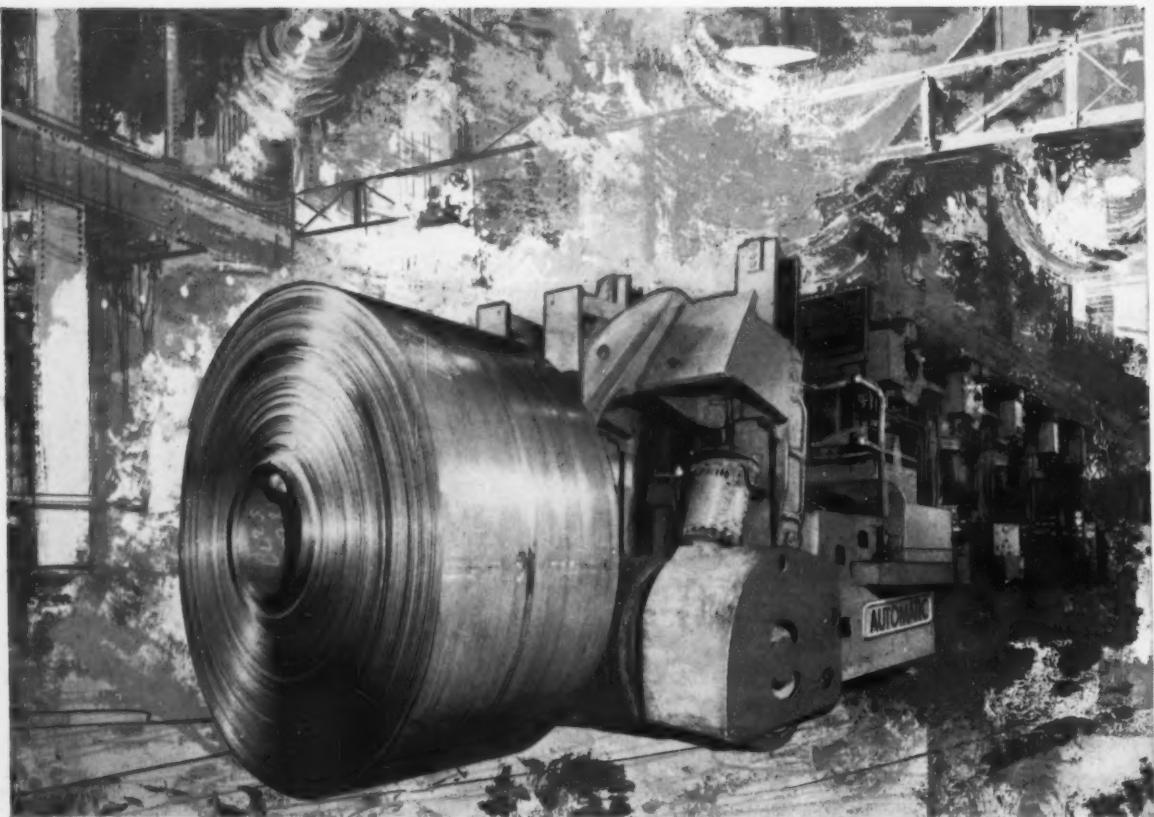
3 UNIQUE TERMS. You can buy TAPE-O-MATIC using our exclusive Trade-in Plan. You can purchase the drill outright, lease it, or lease it with option to buy. **ONE PER CENT CASH DISCOUNT FOR PAYMENT IN 10 DAYS.**

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One turn: Over 1100 tons of tin plate

Kerns "Kleen-Strip"® rolling oil helps pace record turn tonnage

A major mill recently rolled over 1100 tons of tin plate in a single turn utilizing a Kerns "Kleen Strip" rolling oil. Its monthly average turn tonnage record is over 800 tons a turn. One of the reasons tonnage runs consistently high: the rolling oil, formulated and personalized by Kerns United, meets the specific operational requirements of the mill. A good reason why so many mills have turned to Kerns.

This is what a personalized "Kleen Strip" rolling oil can mean to your mill operation...

Easier reductions • Cleaner strip off the mill

and through the anneal • Greater prime yield
• Increased tonnage, with faster mill speeds
• Faster start up after solution change or downtime • Lower mill loads • Lower cost per ton.

Kerns "Kleen Strip"® rolling oils are formulated to meet specific mill requirements, have consistent quality and uniformity from shipment to shipment. They are extremely stable, and when stored over long periods will not deteriorate. And from Kerns you get a complete product, no additives are required. Ask your Kerns representative to call, or write for details.



PERSONALIZED LUBRICANTS FOR INDUSTRY

KERNs UNITED Corporation

828 State Street • Calumet City, Illinois

Subsidiary: Kerns Pacific Corporation, 630 N. Batavia St., Orange, California

®Patents pending

throw block to permit transfer of the feed from press to press.

The feed can handle 0.125-inch thick stock up to 8 inches wide. It has a feed length of 0 to 8 inches and a feed height of 2 to 4 1/2 inches.

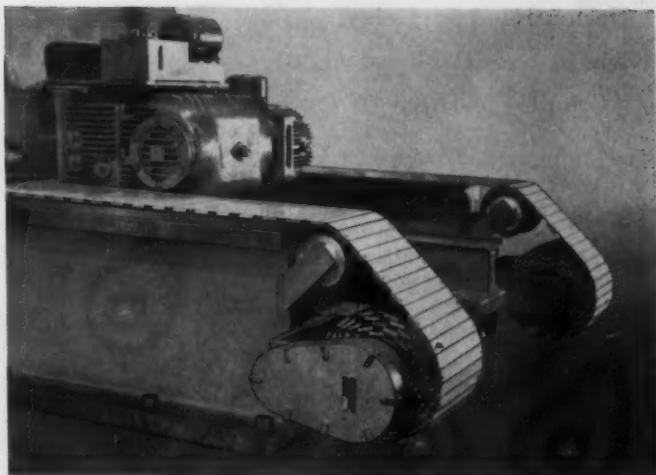
Circle 586 on Readers' Service Card

"Way-Life" Curtain Type Covers for Machine Ways

Futurmill, Inc., Southfield, Mich., has announced a totally enclosed spring take-up motor with constant-torque curtain recoil for practically any length of way-protecting curtain. This feature eliminates cone and cable assemblies and other cumbersome methods of winding up way curtains used to prevent chips and dirt from reaching the bearing surfaces of machine tool ways.

The "Way-Life" curtain, mounting bracket, and take-up motor are an integral unit which can be adapted to either one end or both ends of a machine. The rigid extruded-aluminum curtains (curtain sections are 1 1/2 inches wide, ribbed full length with ball and socket interlocking hinge) are strong enough for operators to walk on. Thus they provide the all important safety for personnel as well as positive protection for the ways and way mechanisms.

Circle 587 on Readers' Service Card



Installation of Way-Life curtain type way covers

Cimtrol Low-Speed Servo Motor

The Cimtrol Division of Cincinnati Milling Machine Co., Cincinnati, Ohio, has developed an Acradrive hydraulic motor which has a displacement capacity of 22 cubic inches per revolution. This unit is designed for applications which require a control motor of extreme stiffness, high torque-to-inertia ratio, extremely fast response, and a wide speed range with ultra-slow speed limits. Uses include positioning drives for machine tools, radar arrays, tele-

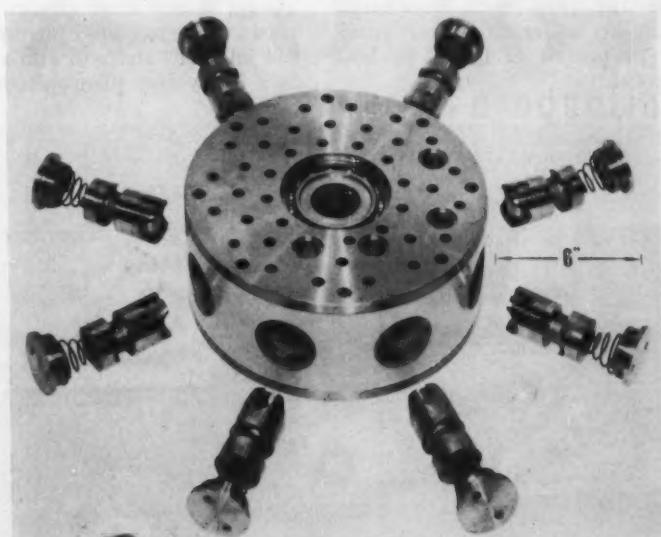
scopes, processing machinery, and other specialized equipment which requires extreme precision and immediate servo response for orientation, location, and speed.

The Acradrive-22 servo motor operates at a recommended maximum pressure of 500 psi, with an effective speed range under servo control of 1/60,000 to 500 rpm. It delivers 3.52 inch-pounds per square inch torque at full capacity with an efficiency of 98 per cent, and reverses 100-rpm rotation in 0.0015 second, and only 0.0006 of a revolution after receiving the signal to reverse.

Eight radial pistons drive the motor through needle-bearing rollers acting on a two-lobed cam which encircles the hollow central spindle. The pistons are always under load; consequently, there is no backlash, even when the motor is reversed at high speed. Because of its high torque-to-inertia ratio and sensitive response even at lowest operating speeds, the motor may be connected directly to a lead-screw or drive-shaft, eliminating the need for intermediate gearing.

The motor measures about 12 inches across by 6 inches thick, and weighs 138 pounds. It has been applied to precision machine tools built by the Cincinnati Milling Machine Co., and is now available to other users.

Circle 588 on Readers' Service Card



Acradrive-22 low-speed, piston type eight-cylinder servo motor with plungers shown withdrawn from cylinders

Norton Hand Surface Grinder and Roll-Form Grinding Machine

The Norton Co., Worcester, Mass., has announced that its Type TS hand surface grinder, Fig. 1, is now being built for immediate delivery in two sizes, 6 by 12 inches and 10 by 16 inches. A prototype of these machines was shown at the 1960 Machine Tool Exposition. These hand surface grinders were designed to meet the needs of toolmakers and diemakers, and for use in school shops, as well as repair shops requiring a low-cost precision grinder.

Features include antifriction bearings under the table designed for effortless hand traversing and an adjustable friction brake that provides additional "drag" if desired. The table-traverse handwheel can be mounted on either side of the table (facilitating use by a left-handed operator) and may be readily adjusted to position the handle for the most convenient short-stroke operation.

The two-speed grinding wheel downfeed handwheel has graduations of 0.0005 inch for fast, accurate positioning, plus a finer control with a vernier which reads to 0.0001 inch. For fine feeding or finishing passes, there is a micrometer feed mechanism with reduction gearing that permits feeding in increments of 0.0001 inch. The 10- by 16-inch model has cross-



Fig. 1. Norton TS hand surface grinder now available in two sizes

feed increments as small as 0.0005 inch. The 6- by 12-inch model has cross-feed graduations in increments of 0.001 inch. An adjustable friction brake also provides drag on the cross-feed. Work-height capacity under a full-sized grinding wheel is 12 inches on both models.

The Norton Co. has also announced a new machine, Fig. 2, designed for form-grinding rod mill rolls. Previously these rolls were turned on a lathe. This 18- by 96-inch form grinder will produce the required shapes on rod mill rolls and will also serve as a heavy-duty plain cylindrical

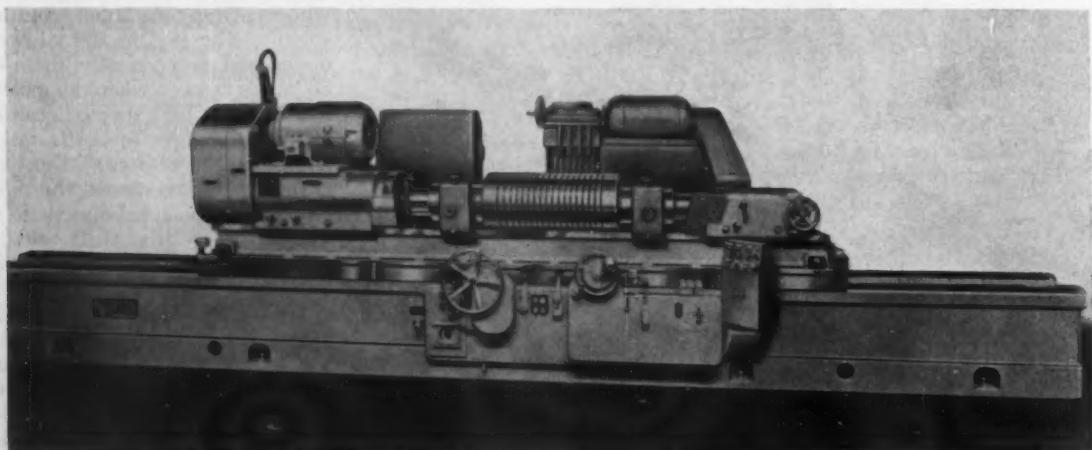
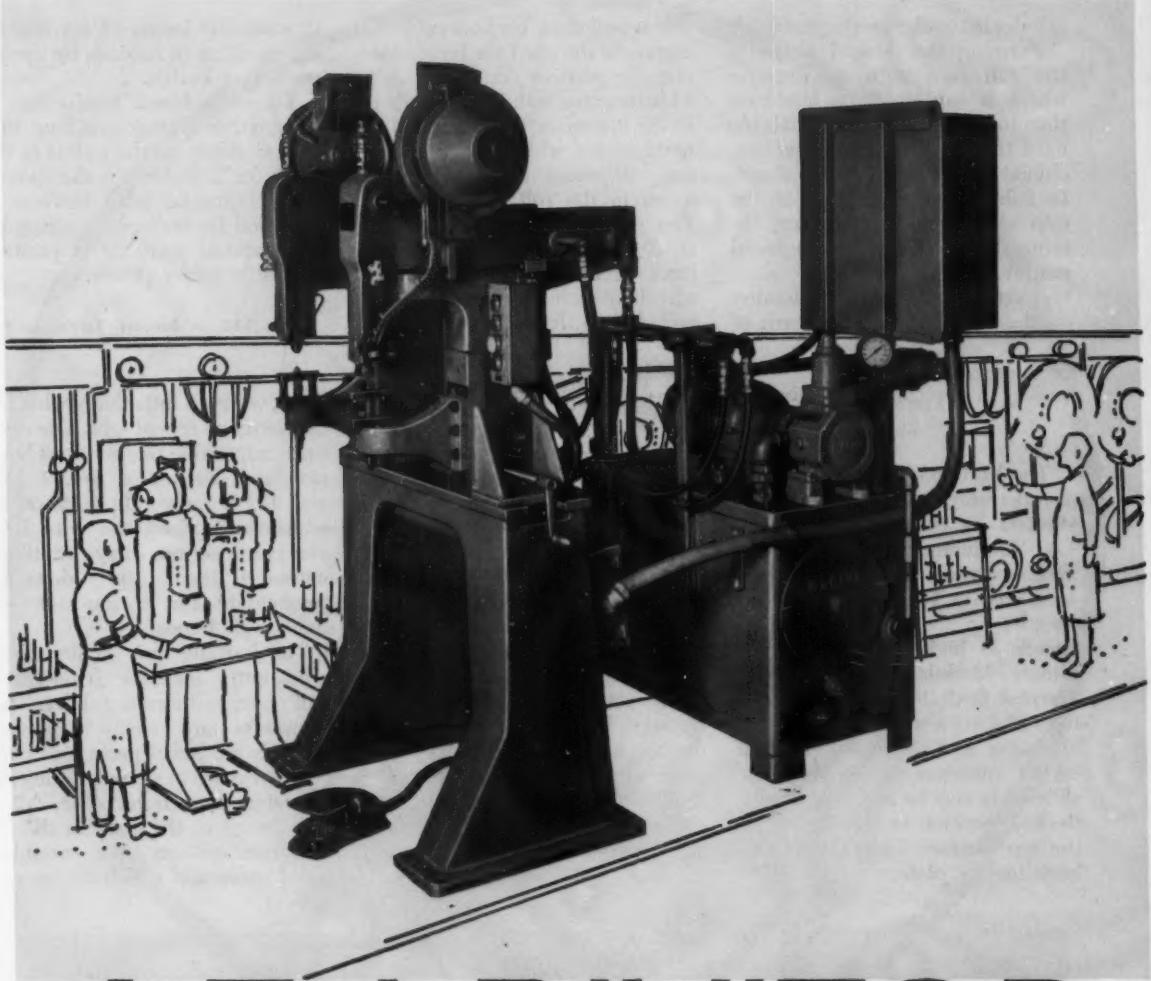


Fig. 2. Rod mill roll-form and conventional cylindrical machine announced by the Norton Co.



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means higher production rate . . . lower unit cost!

T-J Rivitors and Clinchers are designed, engineered and manufactured to conform and operate efficiently on today's high-speed production lines. For whatever your product . . . if it demands a fastening assembly procedure . . . a T-J riveting or clinching machine adds to its high quality standards by their ability

in providing long, rugged service-free life.

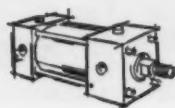
Many standard designs to choose from . . . or a T-J can be custom designed for your exact requirements. Write Tomkins-Johnson, 2425 W. Michigan Ave., Jackson, Mich., today. Ask for Rivitor and Clinchor Bulletin No. 646 or Clinchor Bulletin No. 555.



RIVITORS



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CYLINDERS



CUTTING TOOLS

T-J

TOMKINS-JOHNSON

JACKSON, MICHIGAN

grinder in regular production work.

Forming the desired shape in the roll face with an abrasive wheel is said to take less time than turning. Rolls of materials too hard to turn can be abrasive-machined to form the original shape. In subsequent regrounding of the rolls after periods of service, the original shape can be restored readily.

A crush-truing device mounted on the wheel-slide at the back of

the wheel uses backup rolls that eliminate the need for large-diameter, expensive crushing rolls. This machine will handle rolls up to 30 inches in diameter and up to 12 inches wide. In many cases, this will permit machining several forms in the roll simultaneously. The grinding wheel will operate at 10,000 sfpm to achieve rapid stock removal. An automatic wheel-balancing arrangement is included so that the operator can

dynamically balance the wheel on the machine in seconds by merely pushing a button.

The wheel-feed mechanism is designed to plunge-grind up to 1 inch in depth on the radius of the work (or 2 inches on the diameter). Hydraulic table traverse is provided for traverse grinding on conventional work or to position the table under power.

Circle 589 on Readers' Service Card

Torrington "Verti-Slide" for Forming Wire and Strip Parts

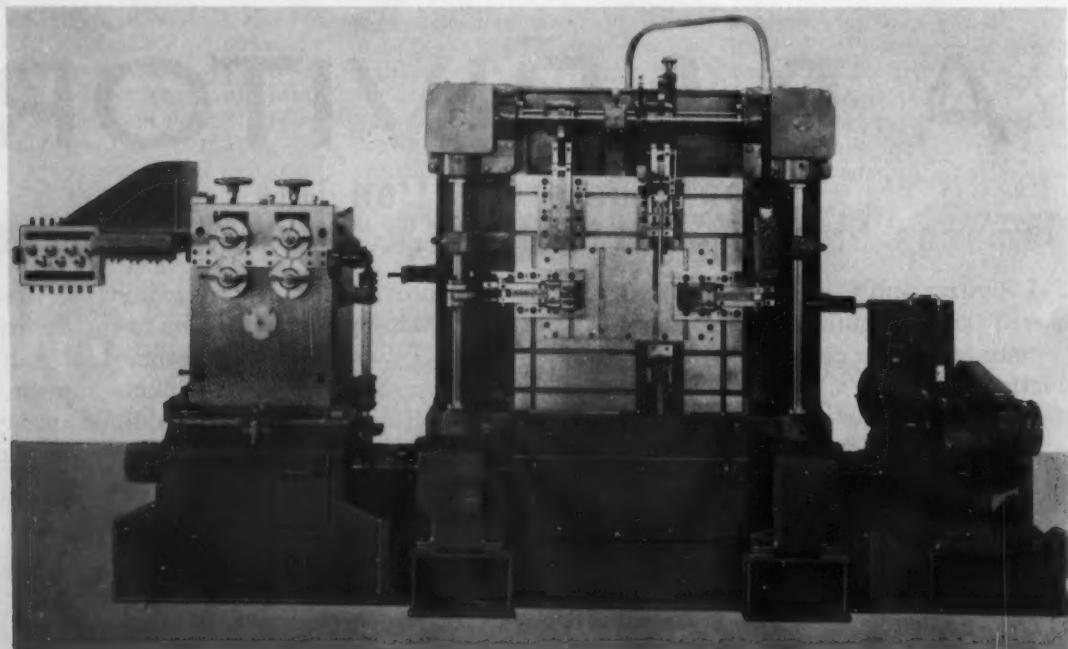
The VLW-83 "Verti-Slide" metal-processing machine recently developed by the Torrington Mfg. Co., Torrington, Conn., has been specifically designed for forming long wire and strip parts at feed lengths up to 24 inches and at speeds as high as 120 parts per minute. Modular design provides unusual flexibility and versatility in producing a wide range of metal shapes and forms. As many as eight interchangeable forming-slide units may be mounted at any desired position in the T-slots at the top, bottom, and sides of the large tooling plate.

Maximum-size wire handled on this machine is 0.250 inch in diameter for limited bends and 0.207 inch for unlimited bends. The maximum width of strip stock handled is 3/4 inch. Standard slide strokes are 2 1/2 inches at top (4-inch stroke also available) and 4 inches at bottom and sides. Slide actuation may be either through box cams for high production or more economical plate-cams with spring or air return for short runs.

The center form may be adjusted over a lateral range of 24 inches in the 13 7/8- by 26 5/8-inch tool

plate, which is interchangeable for fast setup on repeat jobs. The multiple, adjustable rear motions have maximum strokes of 3/4, 1 1/8, and 1 1/2 inches. In addition to adjustments along the wire line, the rear motions may be tilted within 10 degrees up or down to compensate for spring-back on right-angle bends.

The forming unit (center in illustration) includes camshafts, tool plate, and forming slides. The camshafts are easily removed through the bevel gears and corner gear cases to permit adding or removing cam hubs. The drive unit shown at the right in the illustration consists of a variable-speed drive and a belt-driven re-



Verti-Slide wire and strip metal-processing machine developed by the Torrington Mfg. Co.



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assure this kind of *dependability*. They are precision made, guaranteed to meet your specifications exactly!



Ask for this brochure—CINCINNATI custom gears are made in all types to 72" diameter cut teeth, 39" shaved teeth, 25" ground teeth.

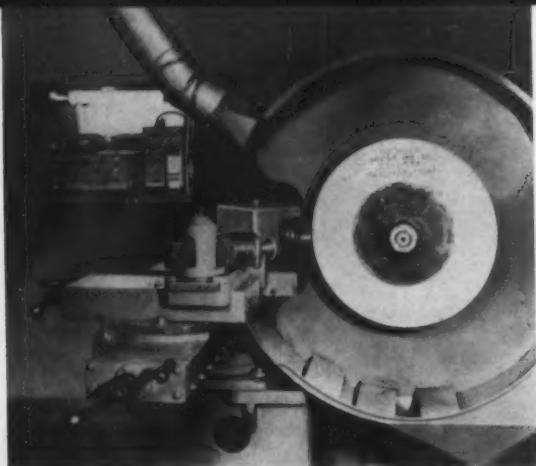
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Cincinnati 27, Ohio

Custom Gear Makers Since 1907 GEARS, good gears only





Dyna-Grader for testing hardness of grinding wheels



Chicago press brake announced by Dreis & Krump Mfg. Co.

duction section, and may be coupled to either side of the unit.

A handwheel on the extended input of the reduction section may be manually engaged and disengaged for setup. The feed unit shown at the left contains four spring-backed feed-rolls. The slide gears may be manually set for either 90- or 180-degree feed. The feed unit may be moved in or out to change the wire-line distance to the forming area. Presses, also powered from the lower camshaft, may be located on the wire line at either side of the forming unit. Over-all dimensions of the feed-forming-drive unit arrangement are 78 1/2 inches high, 143 1/2 inches long, and 40 inches wide.

Circle 590 on Readers' Service Card

Press Brake with Large Die Area

A Chicago press brake of 150-ton capacity with a die area of 60 by 216 inches has been announced by the Dreis & Krump Mfg. Co., Chicago, Ill. This machine is designed for multiple punching, piercing, and blanking operations on large steel sheets, i.e., used in

fabricating showcase side panels.

Instead of the conventional single-plate bed and ram, the machine has a two-plate, cross-ribbed box type slide and a two-plate, cross-ribbed bed. It is available in capacities up to 500 tons.

Circle 591 on Readers' Service Card

Grinding-Wheel Hardness and Uniformity Testing Device

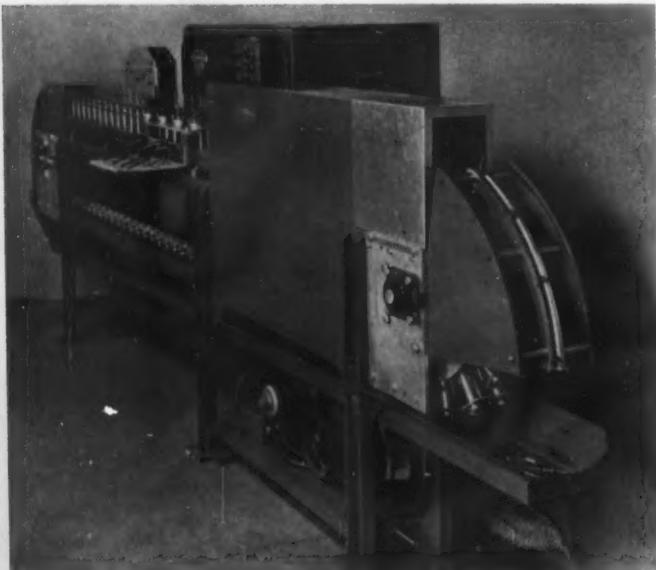
An electronic device called the Dyna-Grader has been developed for testing the hardness and uniformity of a grinding wheel across its entire cutting face while the wheel is rotating. Test results,

electronically recorded on a permanent tape, provide a guide for wheel manufacturers to improve uniformity and help users by improving quality control of their production grinding.

Developed under the direction of the research and development department of the Macklin Co., Jackson, Mich., the testing device passes a conical steel cutter across the face of the moving wheel and crushes minute amounts of abrasive from the wheel surface. Forces required to crush the abrasive are electronically measured.

The Dyna-Grade system of wheel testing is now in use by the Macklin Co. for inspection and quality control on their high-production grinding wheels.

Circle 592 on Readers' Service Card



Ther-Monic automatic conveyor type brazing machine equipped to assemble kitchen utensil

Automatic Brazing Assembly Unit

A Ther-Monic conveyor-belt type machine for automatically brazing blades to stems of beater assemblies has been built by the Induction Heating Corporation, Brooklyn, N. Y., subsidiary of

introducing

DASCO 950

WATER-MIX CONCENTRATE

CUTTING FLUID COSTS GO DOWNHILL!

Reasoning is simple—with STUART'S DASCO 950 and water, you can now replace many of the sulfurized or sulfo-chlorinated straight oil type cutting fluids you're now using to perform the tougher operations on materials in the medium to severe range of machinability: low carbon steels, alloy steels, stainless steels, and high temperature alloys.

To replace these straight oils, use DASCO 950 and water for: tapping and threading—spline and contour broaching—gear shaping and generating—gear hobbing, automatic bar and chucking machine work, or where high surface finish requirements prevail on drilling, milling, reaming,

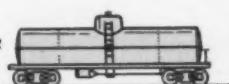
boring or lathe operations performed on soft, tough, stringy materials.

DASCO 950 provides effective anti-weld protection in the form of a very active type sulfur, as well as protection against excessive front clearance wear as a result of its two chemical lubricity additives.

Furthermore, you're insured against rough finishes due to chip welding or excessive built-up-edge. You gain proper chip formation, savings in tools through less frictional wear and cooler cutting.

If you're interested in replacing straight oils—reducing cutting fluid costs—improving job performance, contact us!

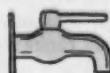
WHY BUY A TANK CAR
OF CUTTING OIL...



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PLUS WATER...
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Stuart

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43 Upton Road, Scarborough, Ontario, Canada

Hathaway Industries, Inc. This machine will be used by a well-known manufacturer of kitchen appliances. It consists of a Ther-Monic work station, and a 20-kw induction generator, equipped with the new conveyorized system that maintains a production of 1200 completed units per hour.

Production spot checks made during operation prove that the joints are so completely brazed that they cannot be twisted off by the severest tests. Only one operator is needed to handle the unit, and the entire system is push-button operated. Moreover, the operator needs no special skills or training to handle the loading and monitoring of the equipment. The conveyor mechanism is operated by a variable-speed drive, which makes it readily adaptable to other production requirements.

Circle 593 on Readers' Service Card

Birdsboro Combination Hot- and Cold-Molding Press

The Birdsboro Corporation, Birdsboro, Pa., has designed a combination back-to-back hot- and cold-molding press that does the work of two separate presses but requires only a one-press operating crew. Production with the new arrangement is fully automated from loading to unloading. One crew of men produces as much as two crews of men ordinarily needed to run two presses. Fig. 1 shows diagrammatically the plan arrangement of the equipment, and Fig. 2 shows an elevation of the two presses and control pulpits.

The combination consists of a 450-ton hot press and a 100-ton cold press engineered, in tandem, to mold laminated plastics, rubber, grinding wheels, plywood, and any material requiring a heating and cooling curing cycle. Both presses have loading and unloading racks to facilitate handling.

Each unit has a 24- by 24-inch working area with five or more openings for the insertion of work. Five or more molds can be pressed simultaneously. Any one of five openings can be selected by push button for loading or unloading.

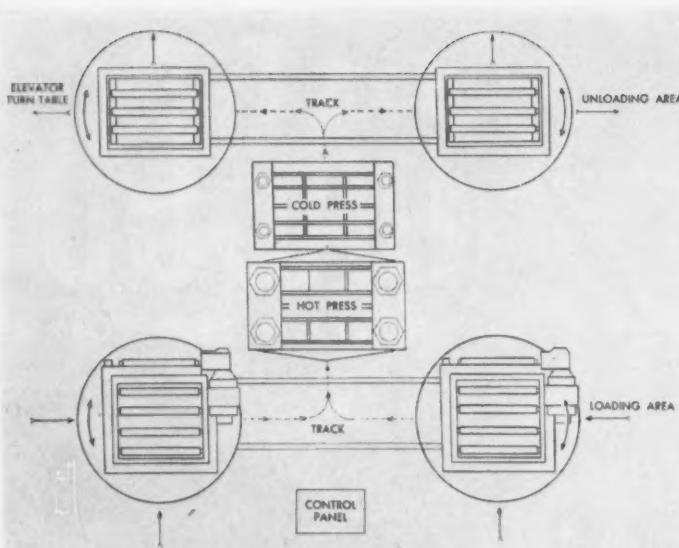


Fig. 1. Diagram showing arrangement of new Birdsboro combination hot- and cold-molding press

For further flexibility, either press can be operated independently and automatically of the other.

When the presses are operated independently, the load racks can be used for both loading and unloading. The unloading racks, however, are for unloading only. The entire press combination is

operated by a hydraulic pump system and electric motor drive fully interlocked and automated. The new hot- and cold-press combination can be built to any tonnage requirements from 100 to 10,000 tons.

Circle 594 on Readers' Service Card
(This section continued on page 190)

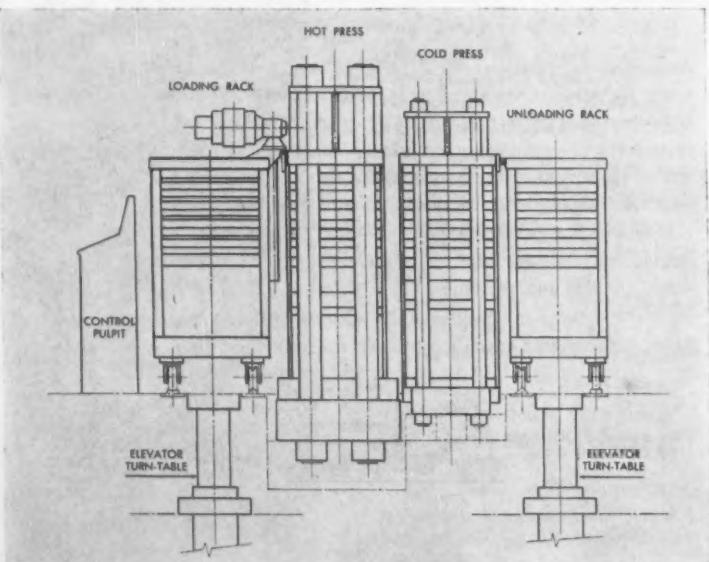
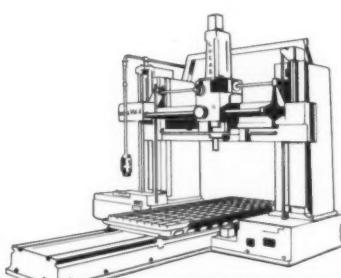
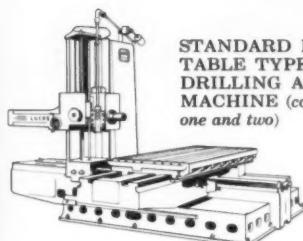


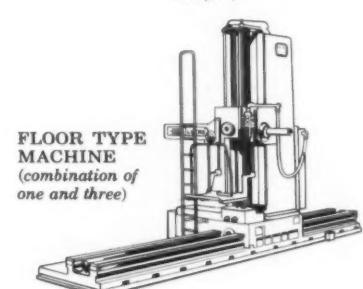
Fig. 2. Elevation of two presses and control pulpit of combination hot- and cold-molding press, Fig. 1



STANDARD HORIZONTAL
TABLE TYPE BORING,
DRILLING AND MILLING
MACHINE (combination of
one and two)



VERTICAL MACHINE
(combination of one, four
and five)



FLOOR TYPE
MACHINE
(combination of
one and three)

Versatility of Design?

LUCAS

Each Lucas machine—table type, floor type, or vertical—is, in effect, a composite of basic precision-made components, with *integrally cast beds*, assembled to meet your specific requirements. This progressive building-block approach to boring, drilling and milling machine design results in (1) the widest range of field-tested machine models, (2) the same high standards of performance regardless of which type machine you specify, (3) the widest possible range of work with the least number of extra gimmicks and gadgets for so-called "special" jobs. When you want the best that your machine tool dollar can buy, talk to the people who pioneered in the development of the horizontal boring, drilling and milling machine. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Ave., Cleveland, Ohio.

NOTE: In order to better define the basic components, we have shown main bed castings separated. In actuality, all bed castings are massive integrally cast units providing maximum rigidity for highest precision.

LUCAS
PRECISION

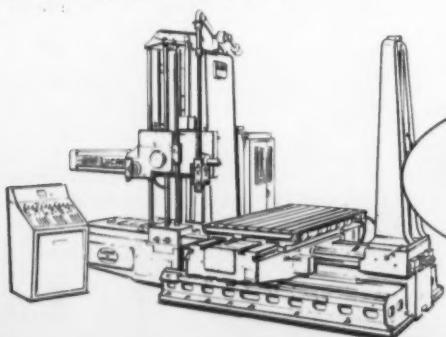
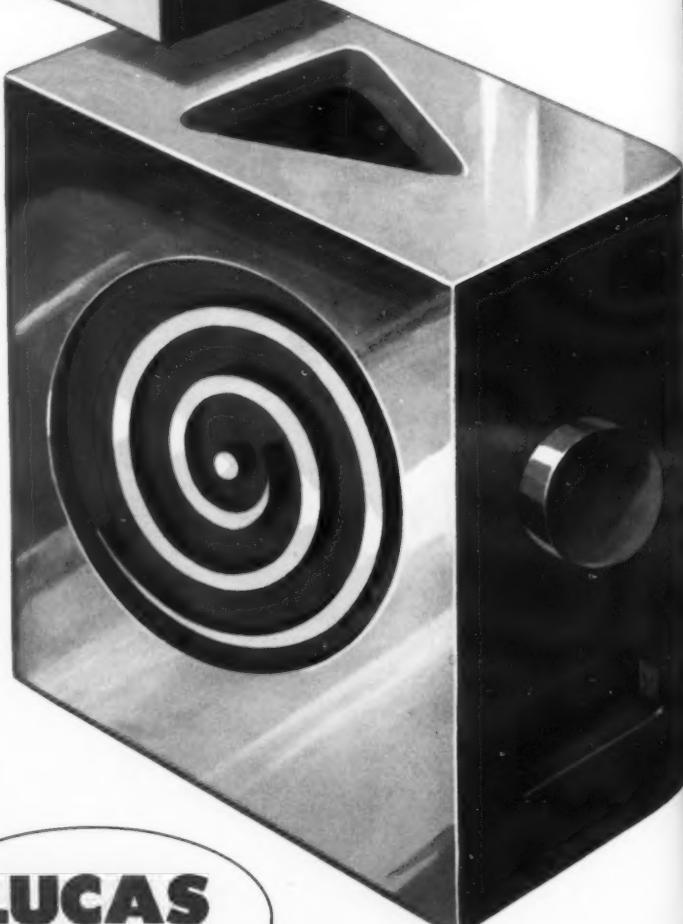


Tape Control?

LUCAS

By offering the widest range of precision table type and floor type boring, drilling and milling equipment . . . by being able to perform the widest range of point-to-point and contouring work . . . by closely coordinating our efforts with the leading producers of numerical controls, Lucas is better able to provide the numerically controlled boring, drilling and milling machines you require.

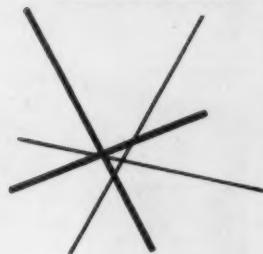
No longer something to read about and think about, good tape controlled equipment is working hard in more and more plants to provide the competitive edge that spells the difference between profit and loss. A numerically controlled Lucas can help you now to cut lead time in the form of direct and indirect labor, reduce inventory, greatly reduce or eliminate jigs and fixtures, eliminate human error, etc. The list is a long one and your Lucas representative is the man who can spell it out book, chapter and verse. Review your requirements with him for a knowledgeable proposal for a numerically controlled Lucas to fit your specific needs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio.



LUCAS
PRECISION

Isabel Shamlian
Charles O. Herb, Jr.

NEW CATALOGUES



**Catalogues bring details of new products to prospective buyers
in clear, concise form. Yours for the asking . . . use postcard on pp. 183 & 184**



Tool Control Boards

Royal Design & Mfg., Inc., Madison Heights, Mich. Catalogue on a wide range of tool control boards equipped with cyclemeters. Also shown is a three-board unit wherein the central board contains master electrical system, counters, etc.

Circle Item 501 on Inquiry Card



Sheet-Steel Separators

Magni-Power Co., Wooster, Ohio. Brochure presenting a complete line of twenty-nine standard-model permanent-magnet separators for handling and separating oily or slippery steel sheets or blanks of every gage, sheet size, and stockpile height.

Circle Item 506 on Inquiry Card



Magnetic-Tape Certifier

Cybertronics, Inc., Waltham, Mass. Bulletin 61-CA on an automatic inspection system that locates defects likely to cause loss of information in tapes used for computers, instrumentation, telemetering, and control systems. Operating principles are given.

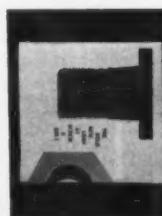
Circle Item 502 on Inquiry Card



Solid Lubrication

Alpha-Molykote Corporation, Stamford, Conn. Bulletin 132 discussing the theory and use of solid lubricants. Such barriers to effective lubrication as galling and seizing, extreme pressures, high friction, chemical reaction, temperature, etc., are covered.

Circle Item 507 on Inquiry Card



Fasteners

Screw & Bolt Corporation of America, Pittsburgh, Pa. Folder detailing the company's varied fastener line, design capabilities, and operations. Screws, bolts, washers, and rivets produced to meet the regular demands of industry are illustrated.

Circle Item 503 on Inquiry Card



Flash Butt Welders

Sciaky Bros., Inc., Chicago, Ill. Bulletin containing information on air-operated BPR.O series flash butt welders, covering frame sizes 1 to 4 and 20- to 250-kva ranges. Machine data, maximum welding capacities, and typical applications are given.

Circle Item 508 on Inquiry Card



Hold-Down Tools

Illinois Metal Products, Chicago, Ill. Folder providing data on "Imp" tools, including hold-down vises and jaws, mules, and an inner-groove "Mike," engineered for measuring the critical tolerances of internal grooves for O-rings, retaining rings, etc.

Circle Item 504 on Inquiry Card



Solid Carbide Tools

Atrax Co., Newington, Conn. Brochure giving application information and prices on small, very small, and miniature precision-ground solid carbide tools. Micro-Drills, miniature end mills, stub routers, hole-grinding burrs, etc., are featured.

Circle Item 509 on Inquiry Card



Pumps

Oilgear Co., Milwaukee, Wis. Bulletin 47740 featuring a line of electro-hydraulic servo-controlled pumps and system components. How the pumps and components work, what functions they perform, and where they are applied are described in detail.

Circle Item 505 on Inquiry Card



Spot Welder

Ace-Sycamore, Inc., Sycamore, Ill. Catalogue on the Ace "44" spot welder—for maintenance, construction, and light production—which can weld most mild steels up to a combined thickness of 3/16 inch (even galvanized, zinc, or cadmium-plated).

Circle Item 510 on Inquiry Card

catalogues . . . bulletins . . . manuals

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Piston Pumps and Motors

Vickers Incorporated, Detroit, Mich. Bulletin 61-81 presenting 5000-psi piston pumps and motors (Series 120), usable in a wide range of power transmission applications, including extrusion presses, cargo winches, planer drives, and log carriages.

Circle Item 511 on Inquiry Card



Dust Collector

Pangborn Corporation, Hagerstown, Md. Bulletin 916 on a unit type dust collector. How the cloth filter-bag dust-control equipment is made, how it works, its range of use and application, and its special features and details are discussed.

Circle Item 512 on Inquiry Card



Transfer Units

Livernois Engineering Co., Dearborn, Mich. Catalogue covering a complete line of mechanical or cylinder-actuated in-line transfer equipment. The compact, spacesaving units are arranged to fit all types of presses and are adaptable to existing dies.

Circle Item 513 on Inquiry Card



Welding Control

General Electric Co., Schenectady, N. Y. Bulletin GEA-5945 describing a welding control that provides precise timing and transient-free operation for consistent, high-quality welds. Application for spot-, seam-, and bench-welder control is covered.

Circle Item 514 on Inquiry Card



Drilling Machines

Electro-Mechano Co., Milwaukee, Wis. Circular covering a line of 0.010-to 1/2-inch automatic drilling machines for fast small-hole production. Rapid advance to the work, positive depth stop, and rapid withdrawal are some of the features described.

Circle Item 515 on Inquiry Card



Valves and Cylinders

Rivett Lathe & Grinder, Inc., Boston, Mass. Folder showing valve and cylinder models in the 1000 standard Rivett line. Keeper-ring and tie-rod designed cylinders, hydraulic directional and functional flow valves, mounting styles, etc., are illustrated.

Circle Item 516 on Inquiry Card



Boring-Machine Attachments

Ex-Cell-O Corporation, Detroit, Mich. Catalogue No. G4A describing attachments and accessories for Ex-Cell-O precision boring machines. Features and functions of fifteen tool- and work-holding, indexing, positioning devices, etc., are covered.

Circle Item 517 on Inquiry Card



Cylinders

Tomkins-Johnson Co., Jackson, Mich. Bulletin SQ-61 featuring the firm's Squair Head cylinder line, capable of producing maximum force with minimum pressures. Technical dimensions and data are given for 1 1/2- through 14-inch bore sizes.

Circle Item 518 on Inquiry Card



Band Saws

W. F. Wells & Sons, Three Rivers, Mich. Brochure describing the company's Q-14 and QJ-24 metal-cutting band saws. Features include fast cutting with variable-speed drive, minimum stock loss, use of high-speed blades, quick blade changes, etc.

Circle Item 519 on Inquiry Card



Gear-Motors

Ohio Electric Mfg. Co., Maple Heights, Ohio. Circular covering Howell Ohio fractional-horsepower gear-motors for driving such equipment as agitators, blowers, conveyors, baking machinery, food machinery, grinders, mixers, pumps, etc.

Circle Item 520 on Inquiry Card



Machine Tool Rental Plan

DoALL Co., Des Plaines, Ill. Booklet discussing the company's machine tool rental plan. Principal advantages include no capital expenditure, availability of profit-producing equipment when needed, local handling of the lease contract, etc.

Circle Item 521 on Inquiry Card



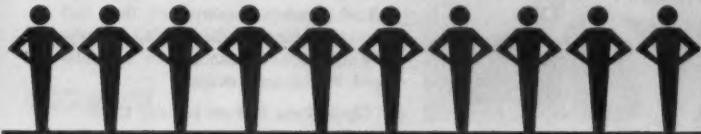
Profilometer

Micrometrical Mfg. Co., Ann Arbor, Mich. Bulletin on the Profilometer and its conformity to ASA Standard B46-1-1955. How to designate characteristics of surface irregularities, how to measure specified surface characteristics, etc., are covered.

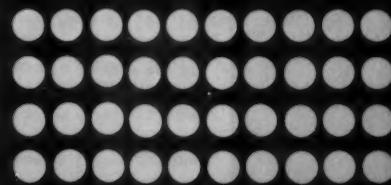
Circle Item 522 on Inquiry Card

A GRAPHIC, MONEY-SAVING STORY OF REVERE BRASS ROD

BEFORE using Revere Brass Rod



10 INSPECTORS



REJECTS RUN
AS HIGH AS 40%

AFTER using Revere Brass Rod



2 INSPECTORS



ONLY 6 REJECTS
IN 30,000 PIECES

A prominent manufacturer of electronic gear was having difficulty with wafer-like brass discs used to maintain the fidelity of tone in its equipment. Rejects were running as high as 40% and a staff of ten inspectors was needed to keep tabs on these seemingly-minor parts.

Revere's Technical Advisory Service was called in for consultation with the manufacturer's engineers. Working together, they found the reasons for the high rejection rate . . . ordinary free-cutting brass rod from which the discs were cut, just couldn't do the job properly. Likewise they found the solution.

Rigid control of molecular structure of the alloy . . . "kid glove" treatment at the Revere mill . . . careful quality control all down the line . . . these produced a brass rod that cut the number of inspectors from ten to two and the rejects from as high as 40% to a startling low of six pieces in 30,000!

Although this rod has a premium price tag, such great

savings per-unit are possible that even the most exacting purchasing executives have been unable to work out a better way to handle the problem.

This story is typical of the kind of savings that can be realized when you work hand-in-glove with your suppliers. It shows how higher first costs sometimes can be made to become lower final costs. Why not bring your metal problems to Revere for solution?



REVERE
COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York 17, N. Y.

Mills: Rome, N.Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles; Redwood City, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities.

Distributors Everywhere

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Gages

Bay State Tap & Die Co., Mansfield, Mass. Catalogue No. 61 containing details on the firm's line of gages. Thread plug, plain plug, thread ring, plain ring, pipe thread plug, pipe thread ring, roll snap types, measuring wires, etc., are covered.

Circle Item 523 on Inquiry Card



Hydroxyacetic Acid

E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Bulletin covering the uses of hydroxyacetic (glycolic) acid — adhesives, copper brightening, dairy cleaners, decontamination cleaning, dyeing, electroplating, electropolishing, masonry cleaning, etc.

Circle Item 524 on Inquiry Card



Boring Tools

Davis Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Catalogue No. D-540 on a line of tooling and setup accessories. Included are standard and special arbors and sleeves, adjustable draw-keys, box type angle-plates, open-side V-blocks, etc.

Circle Item 525 on Inquiry Card



Welding and Machining Facilities

Danly Machine Specialties, Inc., Chicago, Ill. Booklet on Danly's welding, machining, assembly, engineering, and other facilities for jobs ranging from the production of small precision parts to the fabrication of machinery weighing hundreds of tons.

Circle Item 526 on Inquiry Card



Drilling and Tapping Machine

Cleereman Machine Tool Corporation, Chicago, Ill. Catalogue No. 461 on the company's "Series A" automatic-cycle drilling and tapping machine. Dimensions and specifications, standard and optional equipment, and accessories and attachments are covered.

Circle Item 527 on Inquiry Card



Boring-Bars

Vascoloy-Ramet Corporation, Waukegan, Ill. Catalogue 6105 describing V-R microadjustable boring-bars with throw-away inserts. Light, medium, or heavy cuts are possible because of chip control provided by the built-in, adjustable chip-breaker.

Circle Item 528 on Inquiry Card



Bearings

T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin No. 7104 presenting all sizes and styles of "Life-Lube" permanently lubricated ball-bearing pillow blocks, flange units, and take-up units, as well as porous-bronze and babbittted pillow blocks.

Circle Item 529 on Inquiry Card



Chip-Removal Conveyor

May-Fran Mfg. Co., Cleveland, Ohio. Bulletin MF 650-A giving data on Chip-Tote off-the-shelf, hinged-steel belt chip-removal conveyors that will fit all machine tools. Belting, heavy-duty motor, and constant- or variable-speed drives are covered.

Circle Item 530 on Inquiry Card



Gear-Driven Positioner

Arnon Machine Co., Inc., Arcade, N. Y. Booklet discussing a 90-degree forward and 45-degree rearward tilting type of welding positioner. Complete engineering details and specifications are given on models from 40,000- to 350,000-pound capacities.

Circle Item 531 on Inquiry Card



Filter System

Gale Separator Co., Tucson, Ariz. Bulletin 9030-A featuring details on the company's fully automatic "SA" Diatomite type precoat pressure filter system. It is available in sizes from 25 up to 500 square feet of filter area per single unit.

Circle Item 532 on Inquiry Card



Screw Machine Stock

Aluminum Company of America, Pittsburgh, Pa. Manual on machining aluminum intended to aid designers in specifying material, and operators in attaining correct machining practices. Properties and tolerances, estimating information, etc., are given.

Circle Item 533 on Inquiry Card



Storage Planning

Frick-Gallagher Mfg. Co., Wellston, Ohio. Catalogue No. 720 describing spacesaving storage equipment for industry, warehouses, institutions, and general business. Included are Rotabins, bulk storage Rotabins, Klip-Bilt boltless shelving, etc.

Circle Item 534 on Inquiry Card



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Sealant

American Sealants Co., Hartford, Conn. Circular (Form No. 204c) discussing the company's Loctite sealant, a thin liquid that hardens into a tough plastic bond when confined between closely fitting metal parts. Specification tables are provided.

Circle Item 535 on Inquiry Card



Elevating Table

Barworth Inc., Springfield, N. J. Bulletin giving data on the firm's portable hydraulic elevating table, which features adjustable roller guides, dual-speed foot pump, foot-operated lowering valve, steel-plate top, structural steel frame, etc.

Circle Item 536 on Inquiry Card



Drill Bushing Tips

American Drill Bushing Co., Los Angeles, Calif. Brochure providing information on Taper-Lok drill bushing tips and accessories. Lock liner bushings, lock-nuts, lock screws, collars, shanks, etc., are described. A price list is also included.

Circle Item 537 on Inquiry Card



Self-Sealing Fasteners

A. P. M. Corporation, Englewood, N. J. Catalogue H61 on four types of self-sealing fasteners—two of them with Nylok thread inserts. Data on Seelskrews, Seelbolts, Seelrivets, and KaptOskrews for critical high-pressure sealing applications is given.

Circle Item 538 on Inquiry Card



Pelletizing

Nylok-Detroit Corporation, Troy, Mich. Brochure describing and illustrating the firm's complete pelletizing service. Details on Nylok-Detroit's new process for inserting the nylon pellet into all types of nuts and press-fit parts are provided.

Circle Item 539 on Inquiry Card



Threading Machine

Collins Machinery Corporation, Monterey Park, Calif. Brochure presenting the Thread-O-Matic 44 precision threading machine, which threads, cuts, and reams 4-inch pipe in four seconds with fully automatic double chuck. Optional equipment is discussed.

Circle Item 540 on Inquiry Card



Shaft-Position Encoder

A R & T Electronics, Inc., Little Rock, Ark. Bulletin No. 041 describing the Baldwin Model 212 eleven-digit shaft-position encoder. A separate power amplifier is available for increased output, if desired. Specifications and diagrams are included.

Circle Item 541 on Inquiry Card



Cutting Tools

Keo Cutters, Inc., Warren, Mich. Brochure covering standard cutting tools—combined drills and countersinks, keyseat cutters, arbor type keyseat cutters, cutter reamers, lathe mandrels, and machine countersinks. Also illustrated are many special tools.

Circle Item 542 on Inquiry Card



Control System

Hughes Aircraft Co., Los Angeles, Calif. Bulletin No. H 11 on the Hughes MT-4 two-axis positioning system, a numerical-control unit housed in a metal cabinet and a positioning table. It is adaptable to practically any kind of drilling machine.

Circle Item 543 on Inquiry Card



Milling Machine

Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin MM 58 covering the construction and operations of B&S Rangemaster sliding-head milling machines. They are available as either plain or universal types and have 3-hp spindle drive motors.

Circle Item 544 on Inquiry Card



Power Supplies

American Rectifier Corporation, New York City. Bulletin featuring data on the company's complete line of both standard and custom-engineered power supplies, ranging in size from 50 w to 5000 kw. Over 3000 models are listed and described.

Circle Item 545 on Inquiry Card



Presses

Alpha Press & Machine, Inc., Detroit, Mich. Brochure giving information on a line of standard rotary-head die-tryout presses. Dimensions, specifications, and drawings of the 50- to 300-ton capacity presses are provided, including portable models.

Circle Item 546 on Inquiry Card

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Manganese-Steel Castings

American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill. Bulletin on Amsco manganese steel. Covered are the casting process, comparisons with other types of steel, and typical products, such as sheaves, wheels, and rollers.

Circle Item 547 on Inquiry Card



Air Dynamometer

Hydro-Mill Co., Santa Monica, Calif. Catalogue providing data on a completely self-contained, compact and rugged, braking or loading dynamometer for accurate laboratory and production testing and inspection of high-speed motors and turbines.

Circle Item 548 on Inquiry Card



Ball Bearings

New Departure Division, General Motors Corporation, Bristol, Conn. Catalogue covering miniature and instrument ball bearings. Described are the firm's engineering and production facilities as they relate to bearings of the small-sized variety.

Circle Item 549 on Inquiry Card



Turret Drills

Burgmaster Corporation, Gardena, Calif. Catalogue on the firm's six- and eight-spindle tape-controlled turret drilling, tapping, milling, and boring machines. Four basic models and the procedure for programming work and making tape are described.

Circle Item 550 on Inquiry Card



Mechanical Differentials

Dynamic Gear Co., Inc., Amityville, N. Y. Brochure 8101 featuring details on precision mechanical differentials. Design criteria, a group of stock and pre-engineered differential drawings, and a test report on an actual stock differential are covered.

Circle Item 551 on Inquiry Card



Data Processing

Friden, Inc., Rochester, N. Y. Re-designed booklet presenting data-processing systems applications involving the company's tape-operated business machines. The Flexowriter, Teledata, Collectadata, Add-Punch, and Computypewriter are discussed.

Circle Item 552 on Inquiry Card



Drill Heads

Zagar, Inc., Cleveland, Ohio. Brochure (DH-9-61) on heads for drilling, reaming, tapping, and boring. Application and the relation of heads to automation are discussed. Drawings and tables required in basic production planning are included.

Circle Item 553 on Inquiry Card



Lapping Machines

Diesel Control Corporation, Wilmington, Calif. Catalogue SPL-G1 on Spiralap rotary lapping machines. Each is equipped with three spirally grooved plates, an hour meter, and automatic timer that stops the machine after a predetermined number of minutes.

Circle Item 554 on Inquiry Card



Hydraulic Filters

Vickers Incorporated, Detroit, Mich. Bulletin 61-78 providing data on "Tell-Tale" filters for suction-line use in hydraulic systems. They are available in degrees of filtration ranging from 74 to 238 microns and for flow rates from 0 to 120 gpm.

Circle Item 555 on Inquiry Card



Chucks

Kalamazoo Industries, Inc., Kalamazoo, Mich. Folder presenting the firm's universal and independent chucks, whose standard mountings meet the adaptation needs of most standard machines. Other mountings can be provided—with semifinished adapters.

Circle Item 556 on Inquiry Card



Flat Machining

Abraiding Systems Co., Skokie, Ill. Catalogue 861 covering flat machining using the Speedlap process. Typical high-precision applications include mechanical seals, ceramics, stainless steel, sintered metal, electronic components, contacts, etc.

Circle Item 557 on Inquiry Card



Hydraulic Tracer

Detroit Broach & Machine Co., Rochester, Mich. Leaflet (DHT-161) describing a hydraulic tracer conversion unit. Covered are conversion and operational advantages, typical machining applications and part configurations, as well as optional features.

Circle Item 558 on Inquiry Card

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MACHINE TOOLS

For additional information on the Cleveland Crane line of Mechanical and Hydraulic **PRESS BRAKES** circle 18

Ex-Cell-O offers a bulletin on their line of **BUILDING BLOCKS**. Can be used to build simple one way precision machines or huge multistation transfer machines. To obtain circle 19

Armstrong-Blum Mfg. Co. offers a catalog featuring their complete line of **SAWING MACHINES**. To obtain circle .. 69D

New Britain Machine Co. offers a catalog featuring the versatility of application for their **COPYING LATHES**. To obtain catalog circle 75-76

Tomkins-Johnson offers a bulletin featuring their line of **RIVITORS** and **CLINCHORS**. To obtain circle 167

Goss and De Leeuw offers a new illustrated booklet describing their new development of **CHUCKERS**. To obtain circle 202

Ty-Sa-Man offers a bulletin on their **SAW**, cuts accurate squares up to 10 ft. wide—cuts metal or plastics—To obtain bulletin circle 232

L & J Press Corp. offers a catalog featuring complete information on their 20-150 ton straight side, 14-150 ton O.B.I. and 30 to 75 ton gap frame **PRESSES**. To obtain circle 234

Nebel Machine offers a catalog on their high speed **LATHE**—with an exclusive coaxial spindle design. To obtain catalog circle 237

Pacific Press Co. offers bulletin featuring their complete line of **PRESSES & SHEARS**. To obtain circle 240C

For additional information on the Gisholt Machine Co.'s new **SUPERFINISHER**, for flat, conical or spherical surfaces circle 770

Gisholt Machine Co. offers bulletin featuring their line of **TRACERS**, can be used with manual and automatic Turret lathes, and single spindle automatics. To obtain circle 772

Gisholt Machine Co. offers bulletin featuring their **BALANCER**. Eliminates multiple handling and combines location, measurement, automatic correction and inspection. To obtain circle 768

Sundstrand Machine Co. offers bulletin featuring their line of **THREAD-MILLING** machines with: Sine bar adjustment, simple dial settings and fully automatic cycling. To obtain bulletin circle .. 906

Sundstrand Machine Co. offers bulletin featuring their centerless, abrasive belt **GRINDERS**. To obtain this 4-page bulletin circle 908

Barber-Colman Co. offers bulletin featuring their "1610" **LATHE**, 16" or 20" swing and 6 1/2 HP motor. To obtain bulletin circle 910



Federal Products Corp. offers free showing of their new 16 MM, 40 minute color film. Film outlines basic principles of **AIR GAGING** and shows applications. For additional information circle 30-31

Sheffield Corp. offers bulletin "PREC-212" featuring their Pneumatic **RECORDER**. For information circle ... 44

National Broach & Machines' catalog features their Red Ring **GEAR TESTERS**. Can now be equipped with electronic amplifier to measure sound intensity. To obtain circle 78

Niagara Machine & Tool Works Co. offers bulletin on the **TONMETER**, an accurate portable instrument that measures loads imposed on a press. To obtain circle 185



CUTTING TOOLS

Wesson Corporation features circular slide-rule type tool selector which depicts special **CARBIDE TOOLS** for milling, turning, and boring. To obtain write on company letterhead, to: Wesson Corporation, 1220 Woodward Heights Blvd., Ferndale 20, Mich.

National Acme offers 44 page bulletin on their Single Chaser **THREADING**, tool-trips automatically, boosts short run threading efficiency. To obtain circle 43

Bokum Tool Co., Inc., offers catalog covering its line of **TOOLS** specially designed for boring, recessing, and threading operations. To obtain circle .. 182A

Winter Bros. **TAPS**, thread aluminum, brass, copper, ductile steel & die castings by a chipless forming process. To obtain their informative brochure on this process, circle 208

National Twist **DRILLS** detachable heads allow resharpening without removing drill shank from machine. To obtain their bulletin "Target & Center Cut Gun Drills," circle 209

To obtain detailed literature on the Star Cutter Company's line of **GUN DRILLING TOOLS**, circle 213

Two informative handbooks "Faster **GEAR Production**" and "Know Your **SHAPER CUTTERS**" available from Illinois Tool Works. To obtain circle .. 223



Universal Engineering Co. offers a catalog on their line of Production Tools, featuring their **DEBURRING** tool. To obtain circle 80

Texaco—**CUTTING OIL** booklet "Cleartex in Automatic Screw Machines" features cutting oil dilution. To obtain circle 195

Armstrong Bros. Tool Co. offers literature on their complete line of **TOOL HOLDERS**. To obtain circle 212

Barry Controls Co. offers a bulletin entitled "Practical Considerations When Installing Machinery," bulletin features their **MACHINERY MOUNTS**. To obtain circle 216

Lubriplate Div. Fiske Bros. "Data Book" features their grease and fluid type **LUBRICANTS**. To obtain circle .. 218

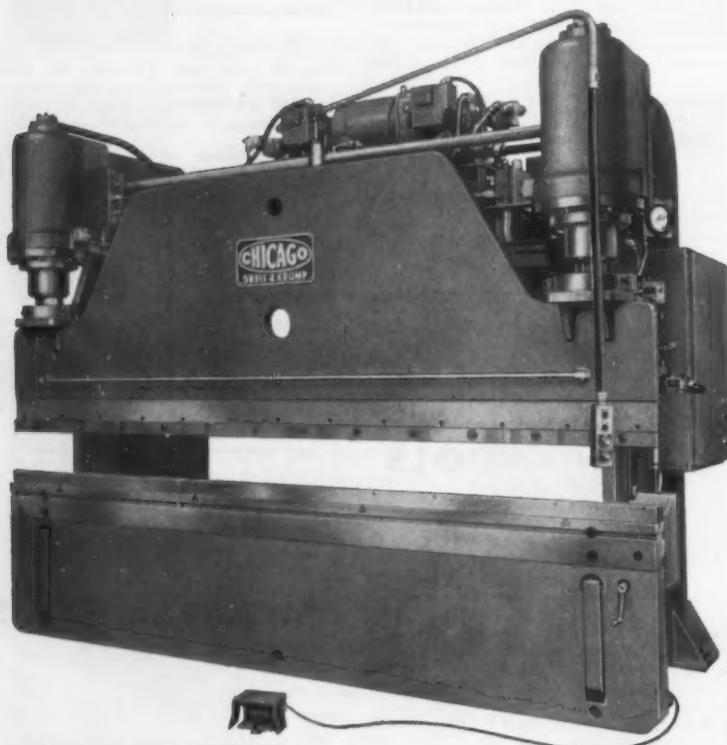
Inland Steel Co. offers informative booklet—"Properties of Ledloy **STEELS**." To obtain circle 233

La Deau Mfg. Co. offers an illustrated brochure on their **TURNOVER CRADLE**. Palletizes and de-palletizes coils in seconds. To obtain literature circle .. 238A

Continued on page 182

Continued from page 181

THE OUTSTANDING Achievement IN HYDRAULIC PRESS BRAKES



NEW CHICAGO Hydraulic PRESS BRAKES

Capacities 100 to 2000 Tons

proved
exclusive
design
features

Long-life Oilgear variable delivery pumps

CHICAGO simplified hydraulic circuit with ultrafine electronic sensing for unmatched ram level control

Infinitely variable ram speeds within the specification limits—controls in swivel pendant or in panel

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Low-voltage control panel

Complete performance facts upon request

1802

Press Brakes • Press Brake Dies
Hand and Power Bending Brakes
Special Metal-Forming Machines



DREIS & KRUMP
MANUFACTURING CO.
7412 S. Loomis Blvd., Chicago 36, Illinois



De Laval Co. offers complete information, including application, performance data, selection information, dimension drawings and tables on their Power-Hydraulic PUMPS. To obtain circle ... 12

Wales Stripper Inc. offers catalog featuring their new HYDRA SPRING. Mechanical or Hydraulic springs develop forces from 2,200 lbs. to 8,500 lbs. For additional information see page 69C

Allen-Bradley Co. offers bulletin 705—featuring their Reversing STARTERS. Starters are available in seven sizes with maximum ratings up to 100 HP, 200 V; 200 HP, 440-550 V. To obtain bulletin circle 153-154

Allen-Bradley Co. offers bulletin featuring their new line of STARTERS. For additional information circle ... 153-154

Cincinnati Gear Co. offers brochure on their line of GEARS, made in all types, to 72" diameter cut teeth, 39" shaved teeth and 25" ground teeth. To obtain circle 169

U. S. Drill Head Co. offers catalog featuring the versatility of their Adjustable DRILL HEADS. To obtain circle ... 211

Boston Gear Co. offers catalog listing 1488 types and sizes of SPROCKETS and CHAINS, and 1781 different "in stock" GEARS. To obtain circle 224

Zagar Inc. offers bulletin featuring their line of DRILLING, REAMING and TAPPING heads. To obtain circle ... 240B

Eisler Engineering Co. offers catalog featuring their line of Custom CAMS—all types of Cams made to your specifications. To obtain catalog circle ... 240E

feel free to use cards below... to obtain free literature on products advertised or described in this issue

1. Circle page numbers of advertisements—if no page number appears on ad, refer to advertisers' index.
2. Circle item numbers of new equipment, catalogue descriptions.
3. Mail . . . we'll do the rest.

For Advertisements—Circle Page Numbers

1	2	3	4	5	6	7	8	9	10	11	12
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COVERS: FRONT — INSIDE FRONT — INSIDE BACK — BACK

For New Equipment, Catalogues—Circle Item Numbers

501	502	503	504	505	506	507	508	509	510	511	512
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information center

Reverse side of this card gives instructions on how to use postcards below to obtain new catalogues, data on new equipment described, and products advertised in this issue.

This card expires March 1, 1962

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Permit No. 53
New York, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

MACHINERY
93 WORTH STREET
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This card expires March 1, 1962

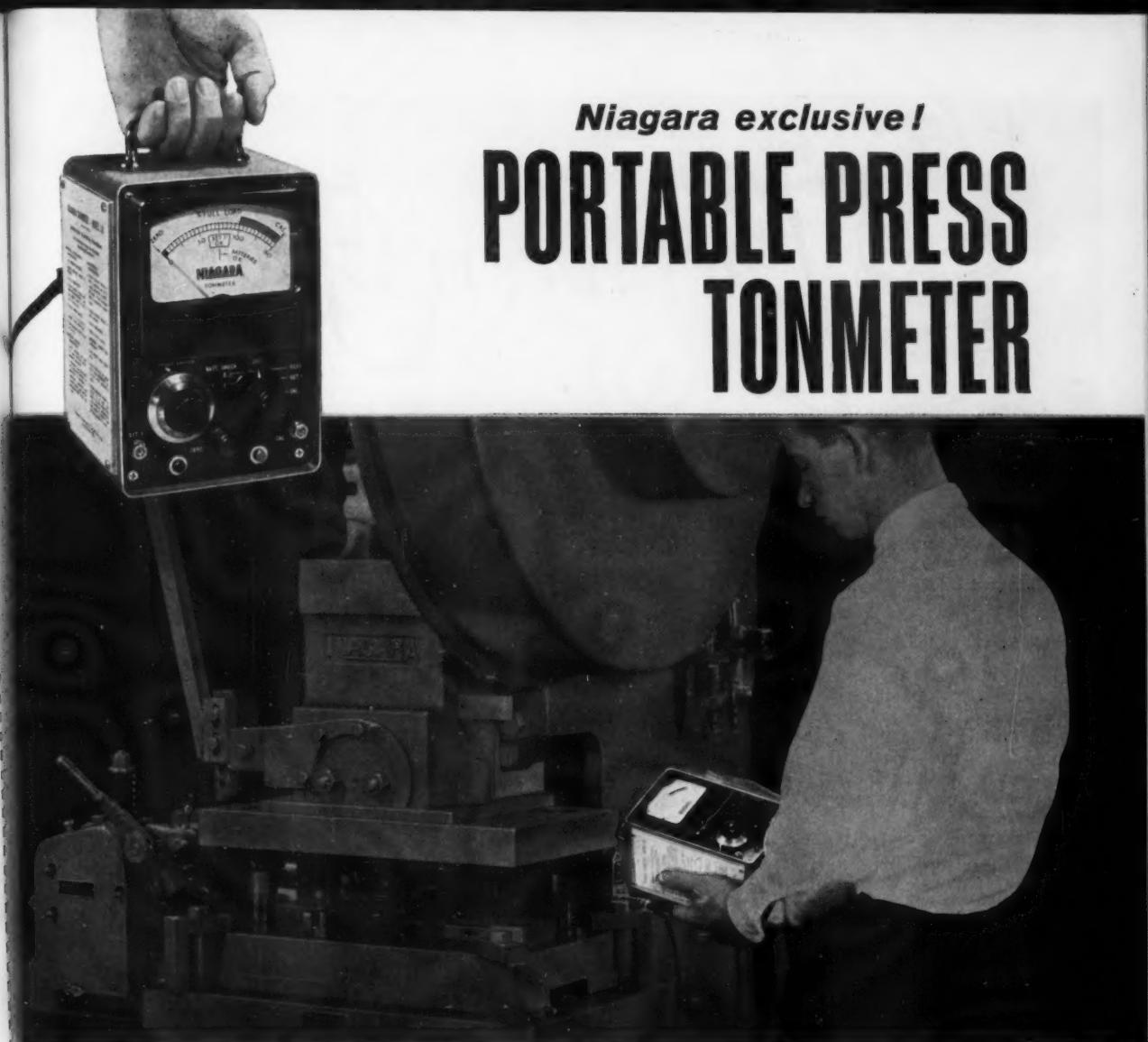
FIRST CLASS
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Niagara exclusive!

PORTABLE PRESS TONMETER

Battery-powered, transistorized instrument contains latest, miniaturized, electronic components.

***protects press and dies against overloads
... pays for itself many times over***

A must for every press operation. Yet it's available only from Niagara . . . and only Niagara presses can come equipped with it!

Tonmeter is a fast, accurate, portable instrument that measures loads imposed on a press during production and takes the guesswork out of die setup. By attaching small electronic pickups to the frame of each press, one Tonmeter can serve your entire plant.

Safeguards against broken crankshafts and cracked frames. Eliminates costly downtime and major repairs. Protects expensive dies from damage. Avoiding just one such overload disaster

can more than pay for your complete Tonmeter installation.

To learn how any new Niagara press or press brake can be factory-equipped with Tonmeter protection . . . write for Product Report No. 2 today. Niagara Machine & Tool Works, Buffalo 11, N. Y. District Offices and Distributors Everywhere.

NIAGARA

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.



Between Grinds

By E. S. Salichs

Cosmic Communication

Having weathered an exciting year chock full of good and bad, we feel that the approaching holiday season with its intent of binding the world in true fellowship is most welcome. So, happy we are to wish all of MACHINERY's readers a very Merry Christmas and Joyous New Year!

Our Best on Brazing

An article on brazing which appeared some months ago in MACHINERY ("Designing Ferrous Parts for Furnace Brazing with Copper") has been incorporated as a standard in an engineering design manual published by the International Telephone & Telegraph Corporation. Prefacing the standard is the statement "This material has been selected for the Engineering Design Manual because of the excellent and concise way in which various joint designs are presented." Thank you, ITT.

In Your Merry Moonmobile

General Motors' Defense Systems Division is making a detailed study of the basic vehicle types that can

be used to explore the moon and planets. Three laboratory models are presently under test: a three-axle vehicle with large wheels suitable for irregular terrain; a tracked vehicle with the track encircling the body, for use on either soft or hard lunar soil; and a multiple-screw configuration which can progress in loose or fluffy soil even if completely buried. No need to come up for air if there isn't any.

Peewee Pellets in Plastics

Tiny glass spheres are being used in reinforced plastics to make moldings stronger yet lighter, according to *Industrial Research Newsletter*. They are 0.002 inch in diameter and weigh about one-third as much as water. And someone imaginatively has named them microballoons.

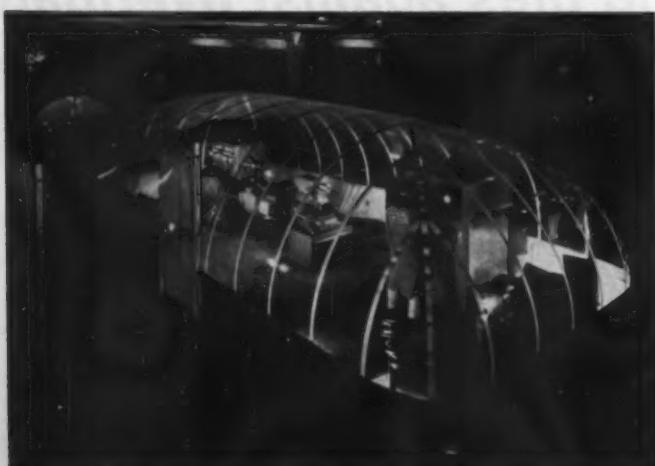
Bargains on Sea Bottom Floor

A \$2,000,000 aluminum research submarine is being built for Reynolds International, Inc., by the General Dynamics Corporation. The Aluminaut, as it will be known, will be operated by the Woods Hole Oceanographic Institution as part of

a research program sponsored by the Office of Naval Research, United States Navy. The sub, designed to operate at depths of 15,000 feet, will permit man to explore about 80 per cent of the world's ocean floor, most of it for the first time, according to J. Louis Reynolds, chairman of Reynolds International. He also said, "The ocean floor is a vast, relatively unknown treasurehouse of minerals, oil, chemicals, and food sources." So don't just come home with a mess of fish.

Ideas, Inc.

A history of patents in *The Lamp* (Standard Oil Co. publication) contained the statement that by 1836 the United States Patent Office housed 7000 models of inventions—a working model then being required with every application for a patent. On Sunday afternoons, Washingtonians would visit the Patent Office to see what was new. This fall, the office was issuing patent No. 3,000,000. Fortunately, the requirement of submitting models was discontinued in 1870. Keeping house at the Patent Office is difficult enough, what with a backlog presently of 200,000 applications to be examined.



A GIFT-WRAPPED LATHE FOR CHRISTMAS?—Not exactly. The plastic "bubble" seen here is used over R. K. LeBlond Tape-Turn lathes during their inspection. The bubble provides ideal conditions for bringing into balance the operating characteristics of the lathes and their tape-control systems. Although not airborne, the bubble is portable.

THERE'S A *hoover* quality BEARING FOR ANY LOAD-LIFE REQUIREMENT

This chart represents relative life, in hours, of various types of bearings in comparable series and size based on uniform speed and load.



DEEP GROOVE Bearings:
R, 30, extra light, light,
medium, heavy series.



"SUPER MAX" Ball
Bearings in light,
medium, heavy series.



DOUBLE ROW Ball
Bearings in light and
medium series.



CYLINDRICAL Roller
Bearings in light,
medium, heavy series.



SPHERICAL Roller
Bearings in five wide-
ly used series.

Hoover's exceptionally wide range of bearing types provides performance characteristics needed for practically any application . . . from high speed intermittent duty to prolonged life under heavy, constant load conditions.

Sizes range from tiny $\frac{3}{8}$ " outside diameter R Series to giant 36" spherical roller bearings. Most

types are available with snap rings, shields, seals or shield and seal combinations.

Outstanding Hoover Quality . . . Micro-Velvet balls and Hoover Honed raceways in ball bearings, Super Finish raceways and rollers in roller bearings, plus other exclusive features . . . assure superior performance. For information contact your Hoover bearing specialist or mail the coupon to us.

Micro-Velvet, *Hoover Honed* and "Super Max" are Hoover Trademarks.

Hoover Ball and Bearing Company
3400 South State Road, Ann Arbor, Michigan

M-18

Please send information on the following Hoover bearings:

Deep Groove "Super Max" Double Row
Cylindrical Roller Spherical Roller

Have Sales Representative Call

Name _____

Title _____

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Address _____

Zone _____ State _____

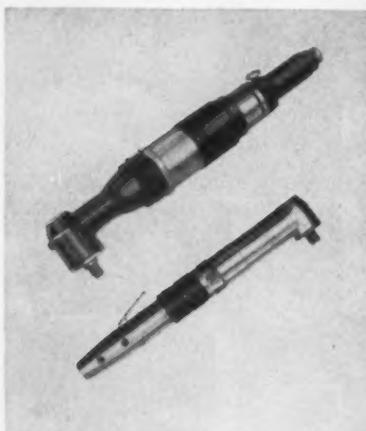
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Zone Sales
Offices and
Warehouses | 8581 South Chicago Ave., Chicago 17, Illinois
290 Lodi Street, Hackensack, New Jersey
2020 South Figueroa, Los Angeles 7, California



CP ANGLE NUTRUNNERS. Top, Angle Nutrunner CP-3090-ATN. Below, CP-3017-ATN. Jolt-free. Easy to hold. Fasteners installed accurately to torque specification. Torque Range: 6 to 200 ft. lbs. Bolt Capacity: $\frac{1}{4}$ " to $\frac{3}{8}$ ".



CP NUTRUNNERS. Top, new "Dial-Tek" Nutrunner, the only power tool you can "dial in" for the precise torque you want. Below, CP-3018-RMNP, offset handle. Torque Range: 20 to 180 in. lbs. Screw/Bolt Capacity: #8 to $\frac{3}{8}$ ".

There's one outstanding characteristic common to all CP "One-Shot" Fastener Driving Tools: the precise torque sensing ability of the tools themselves. Put the tool on the work—press the throttle—and the instant torque is attained all driving action stops. Its torque-awareness is unequalled by any clutch for accuracy and consistency. It will pay you, as it pays the executives in dozens of industries who write us in praise of these quiet, trouble-free tools, to specify CP "ONE-SHOT".



CP "ONE-SHOT" SCREWDRIVERS can save up to 75% in fastener driving time... eliminate stripped threads.



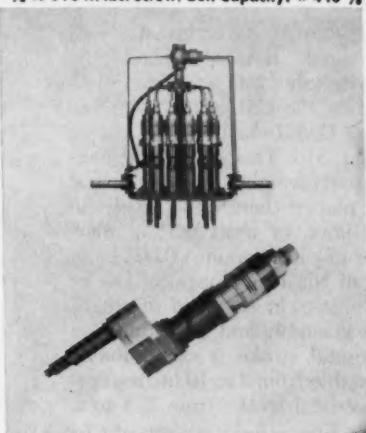
Chicago Pneumatic

PNEUMATIC TOOLS • ELECTRIC TOOLS • AIR COMPRESSORS • DIESEL ENGINES • HYDRAULIC TOOLS • AVIATION ACCESSORIES



CP SCREWDRIVERS. Top, CP-3008-ORTS with pistol grip handle. Below, CP-3012-LMS with silent exhaust. Torque Range: 4 to 100 in. lbs. Screw Capacity: #3 to $\frac{1}{4}$ "

CP MULTI-RUNNER MOTORS. Top, 12-spindle Multi-Runner. Below, CP-3075-MMM Multi-Runner Motor with offset spindle. Torque Range: $\frac{1}{2}$ to 310 ft. lbs. Screw/Bolt Capacity: #4 to $\frac{1}{2}$ "



CP ELECTRIC SCREWDRIVERS & NUTRUNNERS. Top, CP-157 Hicycle (220/3/180) Electric screwdriver. Torque Range: 7 to 100 in. lbs.; screw Capacity: #5 to $\frac{1}{4}$ ". Below, CP-7156 Super Cycle (220/3/360) Nutrunner. Torque range: 40 to 180 in. lbs. Screw/Bolt Capacity: #12 to $\frac{3}{8}$ ".



Here's how 4 companies
eliminate work spoilage,
end field complaints with

CP "ONE-SHOT" TORQUE CONTROL FASTENER DRIVING TOOLS

The 4 case histories described below are typical of hundreds of examples† that prove CP "One-Shot" torque control fastener driving tools can save money for you... eliminate rejects... end field complaints.

A soft pull-up job: A gasket under the handle of a home appliance represented a severe soft pull-up... two screws are involved... torque specified of 20 inch-pounds ± 5 were difficult to meet, handles were cracking. Setting the CP "One-Shot" Screwdriver clutch to the desired torque enabled manufacturer to meet specifications... all readings are 20 inch-pounds.

Reduces spoilage 80%: Manufacturer of a control drives four #8 cover retaining screws into tapped plastic housing. Maximum desired tightness: 7 inch-pounds; stripping torque:

9 inch-pounds. A change to CP "One-Shot" Screwdrivers cut housing spoilage from 10 per hour to 2 per hour, with no sacrifice in work rate.

Keeps repair costs low: Yearly maintenance records at an electronics plant reveal that 30 CP "One-Shot" Screwdrivers have been kept in operation at an average repair cost of only five cents per tool per month. A perfect combination of low cost performance and high level precision.

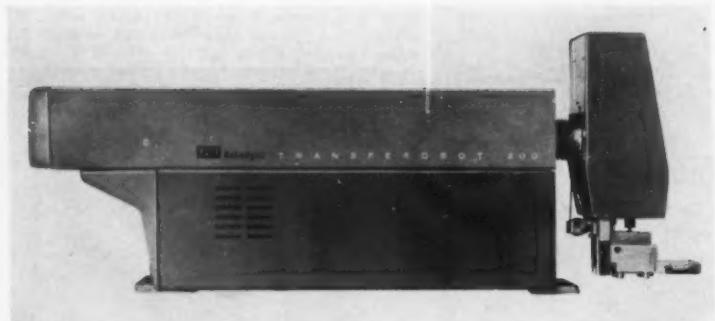
Ends field complaints: Assembling an office equipment unit with #10-32 frame bolts, manufacturer was getting readings from 20 inch-pounds to an excess of 30. Switch to CP "One-Shot" gave uniform readings of 28 inch-pounds, and ended field complaints.

†Details and names of companies are yours on request.

CP manufactures the most extensive line of "one-shot" tools available today. Let a CP Torque Control Specialist help you solve your fastener driving problems. Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N.Y.

Versatile Parts Transfer and Placement Device

A versatile parts transfer and placement device, called the TransfeRobot 200, has been developed by the USI Robodyne Division of U. S. Industries, Inc., Silver Spring, Md. This equipment handles parts weighing up to 1 pound and places them repetitively in dies, jaws, or nests within tolerances of plus or minus 0.002 inch. One of the major applications of this unit is in the field of small-parts assembly and handling. The horizontal stroke is continuously adjustable from 3 to 10 inches, and the vertical stroke from 5/8 to 2 inches. Over-all dimensions are 24



TransfeRobot for transferring and locating parts developed by the USI Robodyne Division of U. S. Industries, Inc.

by 6 by 10 inches, and the approximate weight is 36 pounds. It operates on 60-cycle, 110- to 115-volt alternating current. At mini-

mum stroke conditions, one complete cycle per second may be achieved.

Circle 595 on Readers' Service Card

"Dual Slide" Lathe Designed for Complex Contour-Boring, Turning, and Facing

A new lathe, specifically designed for accurate contour-boring in conjunction with ordinary facing and turning operations, has been introduced by Lodge & Shipley Co., Cincinnati, Ohio. This

machine is called the "Dual Slide" lathe because it has two tool-slides mounted on a single carriage. It is basically a 2516 engine lathe with the two independently controlled cross-slides mounted on

a single special carriage. One slide has a four-way tool-block for turning and facing. The other slide is tracer-controlled and is equipped with a vertically pivoting boring-bar holder. The "swing-up" boring-bar holder on the separate slide permits full indexing of the four-way tool-block down

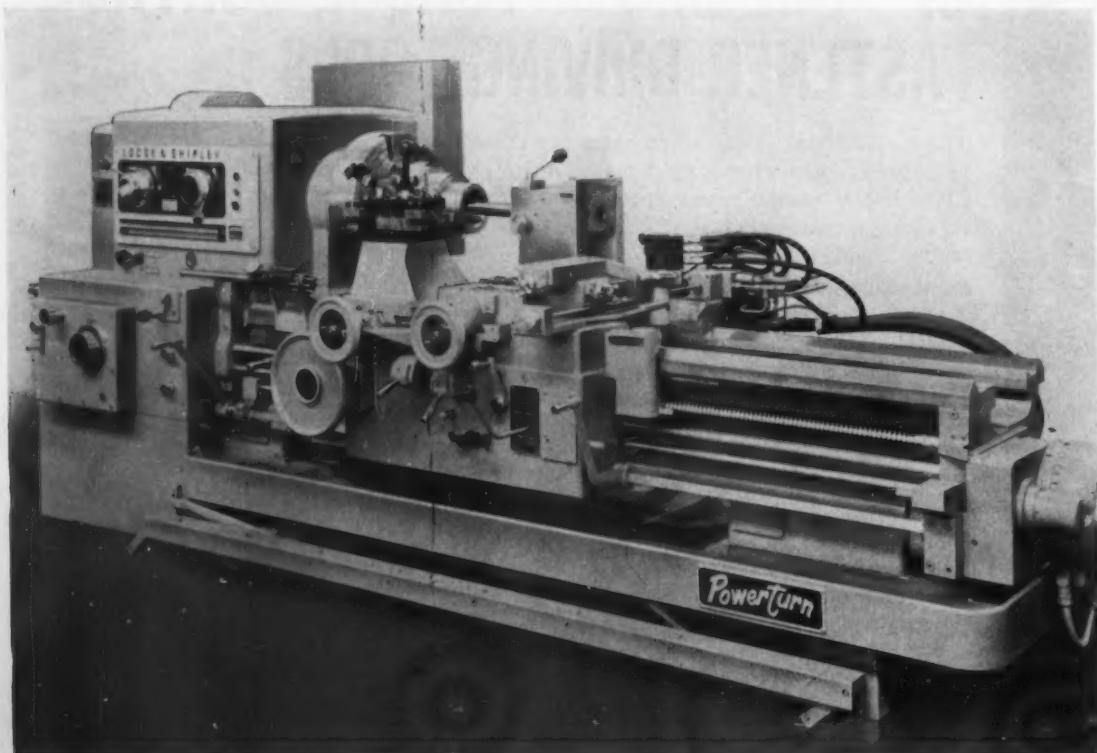


Fig. 1. Over-all view of Lodge & Shipley Dual Slide lathe designed for complex work



QUIET!

...a vital by-product of the rugged frame and precision manufacture of Bliss Big "C" Inclinables

Bliss Big "C" Inclinables whisper where others shout . . . and it's an important reason why their owners are getting more parts per hour, closer tolerances, fewer rejects, and longer die life.

Why? Because noise is simply audible vibration and, the less the vibration the less the wear and the less the rejects.

The designers of the Big "C" licked this vibration problem before it started. They did it with such things as achieving precise fit of all moving parts, balancing of the rotating parts and by using quiet running helical gears on geared presses. Then, they relied on the massive cast Meehanite frame to dampen what little vibration remained.

The result was, as people like Victory Metal Manufacturing Corporation, Plymouth Meeting, Pa., know, a vibrationless press that gives more parts per hour with fewer rejects. Victory, the world's largest manufacturer of commercial refrigerators, has four Bliss "C" series inclinables in day in and day out use giving longer die life and slashing production costs. How about you? If your press requirements include inclinables—or another type—demand Bliss—it's the "profit" press for you.

E. W. BLISS COMPANY • PRESS DIVISION • Hastings, Michigan

Foreign Subsidiaries: E. W. Bliss (Canada) Ltd.; E. W. Bliss (England) Ltd.;
E. W. Bliss Co. (Paris) France, E. W. Bliss-Henschel G. m. b. H.; Düsseldorf, West Germany

PRESSES • ROLLING MILLS • ROLLS • CONTAINER MACHINERY • CONTRACT MFG. • PUBLIC SAFETY

BLISS
SINCE 1857

to the center line of the machine without interference from the boring-bar itself, while still retaining positive location of the boring-bar.

Numerous manufactured parts, because of complexity and accuracy requirements, do not permit simultaneous boring and turning operations, such as are commonly done on turret lathes. Parts of this nature are generally bored in a secondary lathe operation. The Dual Slide lathe minimizes the necessity for secondary operations. With two slides mounted on a common carriage, accurate contour-boring work can be accomplished after the outside diameter has been finish-turned—all in the same setting. Another example of this type of work might be parts with both internal and external threads.

Since the machine was originally intended for contour-boring type work, only the boring slide is tracer-controlled, while the turning slide is operated conventionally through apron feed levers. However, the lathe can also be furnished with both or neither slide tracer-controlled.

The lathe is also equipped with a modulated-feed hydraulic tracer

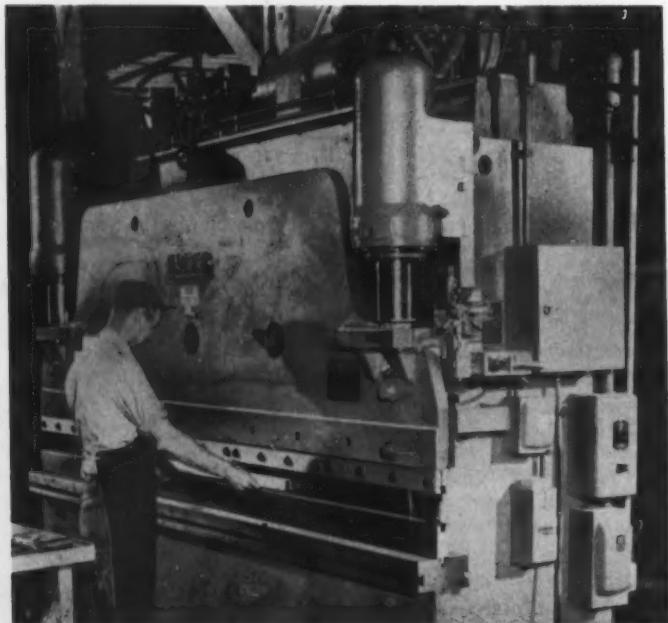


Fig. 2. Close-up view showing swing-up boring-bar of lathe,
Fig. 1, out of way for facing operation

which assures a constant feed rate over all contoured surfaces and a uniform surface finish. It is available in three spindle-speed ranges and can be furnished with a maximum of 30-hp capacity. Other specifications and dimensions are comparable to those of the 2516

Lodge & Shipley standard engine lathe. The usual accessories previously available for the manufacturer's lathes of this type can also be furnished, except taper attachment.

Circle 596 on Readers' Service Card



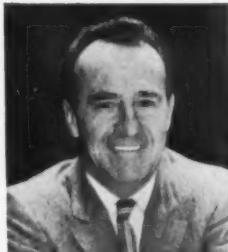
Hydraulic press brake built by Pacific Industrial Mfg. Co.

Versatile Hydraulic Press Brake

The Pacific Industrial Mfg. Co., Oakland, Calif., is building a versatile hydraulic press designed to perform widely diversified production forming operations. One of these presses is being used at the plant of Biersach & Niedermeyer, Milwaukee, Wis. It can be quickly and economically set up to form a wide variety of unique products, using 24-gage sheet to 1/2-inch plate.

With a six-station micrometer depth stop on the adjustable stroke length, the press brake accurately forms several different bends from one die set. The press shown in the illustration is being used to form U-channels at the rate of 400 per hour from 18-gage steel, 48 inches long by 4 7/8 inches wide. The same dies form W-shaped fins from 24-gage steel,

"There's no profit in downtime..."

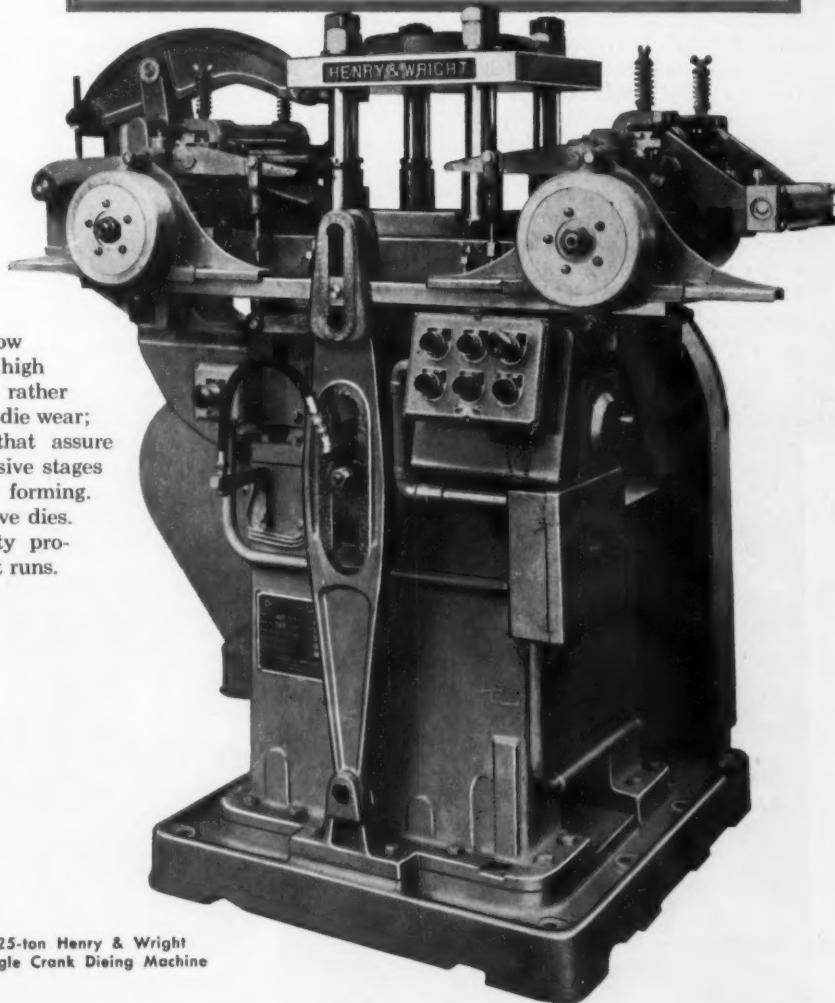


CHARLES A. BARTZ, Plant Supt.
R. Krasberg & Sons Manufacturing Co.
2501 West Homer Street
Chicago 47, Illinois

"Our cost records show that Henry & Wright Dieing Machines produce more parts between die regrinds at higher speeds, take less time for die service which indicates less die wear, and are productive for longer periods of time before die service is necessary. It's like having an overtime worker at straight time rates. H & W's give maximum service at less cost on our toughest pressroom requirements. Here's what our cost records over conventional stamping machines show:"

Henry & Wright Dieing Machine

28.2% increase in running time between die regrinds
43.2% decrease in time required to service dies
126 % increase in production before dies need service



25-ton Henry & Wright
Single Crank Dieing Machine

H·P·M

DIVISION
KOEHRING COMPANY

Mount Gilead, Ohio, U.S.A.

H150



48 inches long by 4 inches wide. Eight hundred cylindrical motor housings were also formed on this press, using shop-made dies which held close tolerances on roundness and end alignment.

Circle 597 on Readers' Service Card

Improved Spherical-Milling Machine

Processing partial-sphere type parts can now be achieved more efficiently and economically as a result of improvements in the recently developed spherical-milling machine built by the Micromatic Hone Corporation, Detroit, Mich. Designed for rough-milling precision full-end and truncated spheres prior to finish-Microhoning them, the new machine incorporates a number of notable design improvements and engineering refinements over earlier models.

For example, an integrated hopper-loader system built into the unit substantially reduces cycle time of four to five seconds to only one-second loading time per part. Production capacity has been increased 9 per cent—from 240 to 260 parts per hour. Also, the im-

proved sizing control system now used makes possible greater accuracy and uniformity in the finished-part size than previously obtainable.

Fourteen of these new spherical-milling units are being installed in one major automotive plant, where they will replace forty-six machines and thus eliminate a total of thirty-two units. The total number of operations in the complete process has been reduced from eleven to seven. Tool costs have also been substantially lowered.

Circle 598 on Readers' Service Card

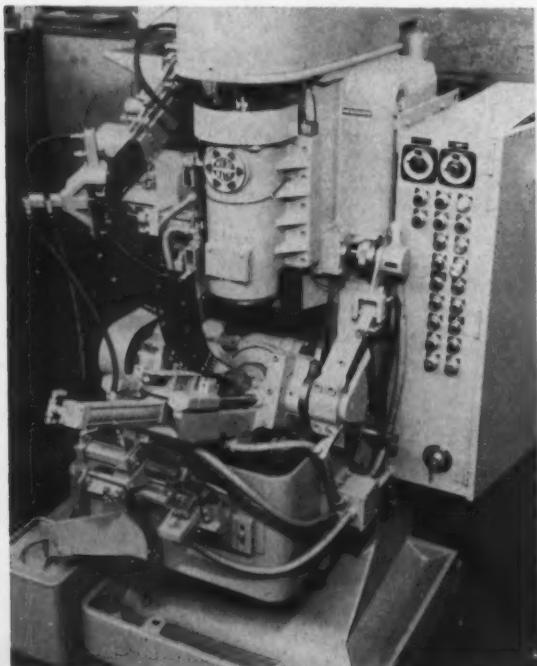
Quick-Acting Automatic Tool Changer

An automatic tool changer has been developed by the Edlund Machinery Co., Cortland, N. Y., as accessory equipment for its Edlund-Matic Model 2N drilling and tapping machine. This tape-controlled unit is designed to speed up all drilling and tapping operations by making very fast tool changes automatically, thus freeing the operator for other work. With this equipment tool changes can be made in five seconds. The

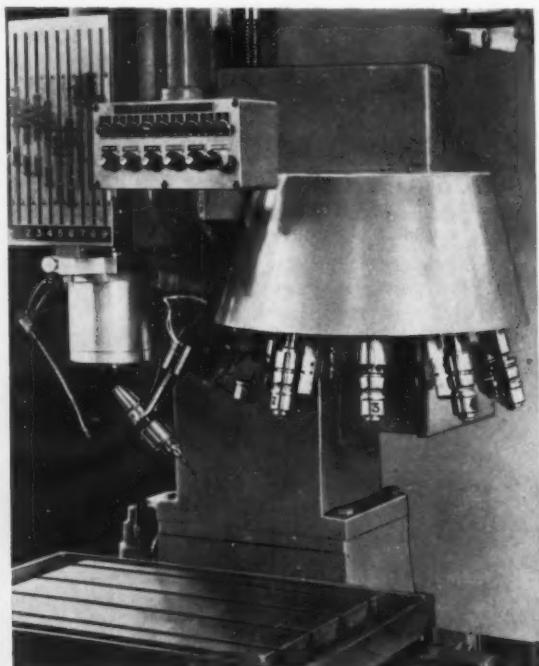
tools can be selected out of sequence as required by the tape or manually.

The unit can carry up to nine different cutting tools which can be manually selected during setup. Once selected, the tools are fitted with adapters and seated in the individual storage positions in the rotating matrix. Then the numerical-control tape takes over, making tool changes and directing the drilling operations automatically without requiring any attention from the operator.

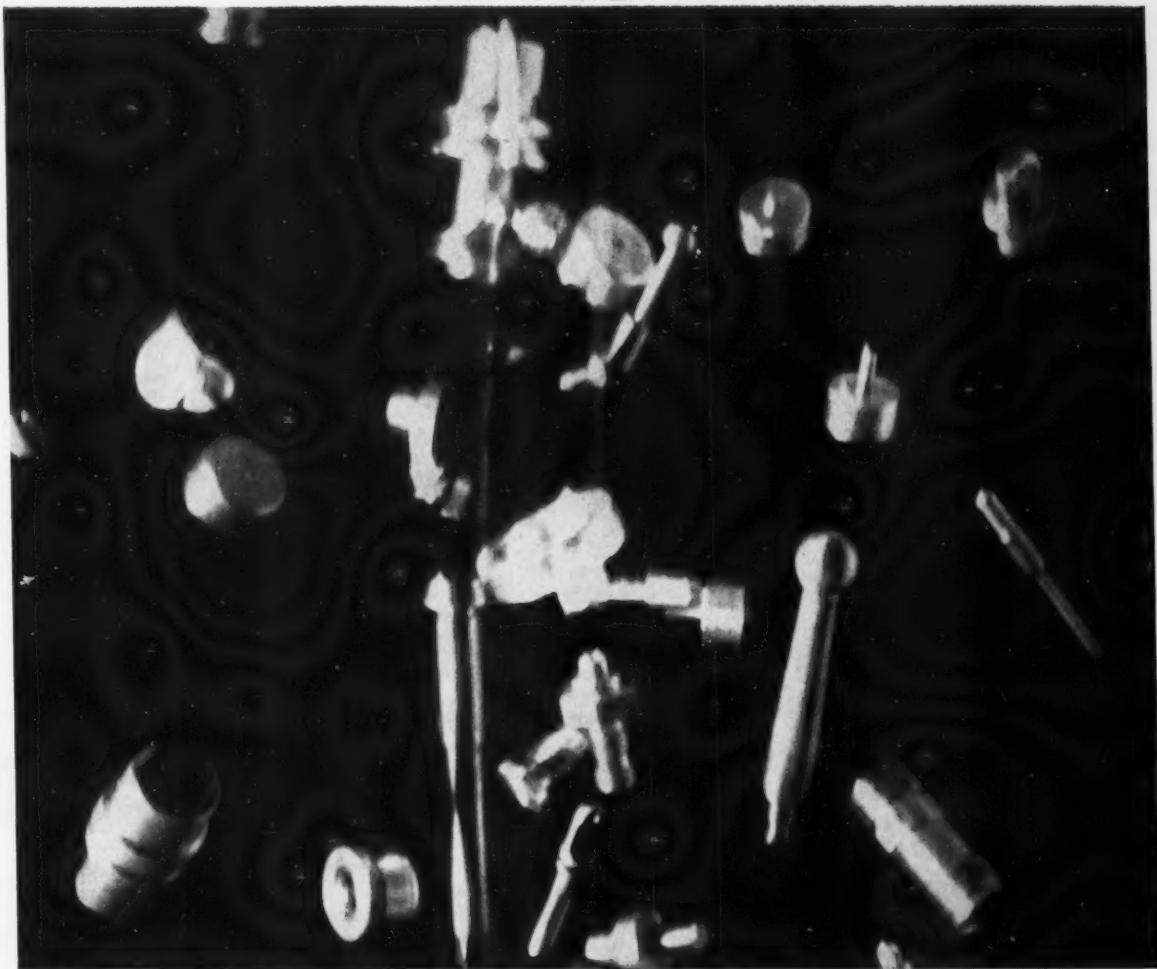
In a typical operation, the cutting tools are held in individual adapters having American Standard taper shanks; these are seated in the different storage positions in the rotating matrix. At the beginning of the operation, the adapter holding the proper tool for the first operation is securely clamped into the nose of the drill spindle automatically. When a tool change is signalled by the tape, two pneumatically controlled fingers grip the adapter in the spindle, and it is released by an air pressure control. The fingers then seat the adapter and tool in the original storage position, and the matrix rotates until the next de-



Spherical-milling-machine of improved design announced by the Micromatic Hone Corporation



Automatic tool changer developed for Edlund-Matic Model 2N drilling and tapping machine



INCREASE PRODUCTION AS MUCH AS 33%

The "Cleartex Cure" ends the dilution problem forever . . . prolongs tool life . . . decreases rejects and downtime . . . and boosts production by as much as 33%

It's seven chances out of ten that lube oil is leaking into the cutting oil sumps of your automatics right now. Diluted cutting oil means shorter tool life, more rejects and downtime—and sharply curtailed production.

How a "Cleartex Cure" works. A "Cleartex Cure" stops this dilution problem cold. Your production can jump as much as 33%. Here's why: Cleartex Oil—heart of a "Cleartex Cure"—is used in *both* cutting and lubricating sumps. It works as a hydraulic fluid, too. Cutting oil strength is always full—regardless of leakage. Because of minimized losses and increased production, *you can actually slash per-piece production costs as much as 40%*.

How to take a "Cleartex Cure." Getting the full benefits of a "Cleartex Cure" is easy. An experienced Texaco

engineer will survey your automatic set-up. He'll tell you which machines will benefit from Cleartex. Our illustrated booklet, "Cleartex in Automatic Screw Machines," spells out the benefits of a "Cleartex Cure" in detail.

To get your copy, plus the survey, contact the nearest of more than 2,300 plants distributing Texaco Products, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y., Dept. MA-130.

Tune In: Huntley-Brinkley Report, Monday Through Friday—NBC-TV

TEXACO
Throughout the United States
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sired tool comes into position where the fingers can grip them. The required tool is automatically taken out of the storage position and placed in the spindle, and the machining operation continues.

This device requires a minimum of clearance between the top of the work and the point of the tool when it is in position. The longer tools require as little as 7/8-inch clearance over the top of the work, and the shorter tools require slightly more.

Circle 599 on Readers' Service Card

Eight-Station Mag Turret Head

A Mag turret head with an eight-station super air-lock turret that can convert any make or size standard engine lathe into a versatile chucking machine has been announced by the Logan Engineering Co., Chicago, Ill. The Mag turret head is said to cut machining time and speed up tooling.

The turret replaces the entire



Mag turret head announced by the Logan Engineering Co.

compound, eliminates the tailstock, and is designed to lessen operator fatigue and strain. It provides an extremely rigid tool mounting and permits repeat indexing that is claimed to be accu-

rate to within 50 millionths of an inch. Dovetail tool-blocks with adjusting screw center the tool. All moving parts are hardened, ground, and chrome-plated.

Circle 600 on Readers' Service Card

Heavy-Duty Metal-Cutting Band Saws

W. F. Wells & Sons, Inc., Three Rivers, Mich., is introducing two horizontal metal-cutting band saws. Both are designed and built for heavy-duty, high-speed production cutting with high-speed

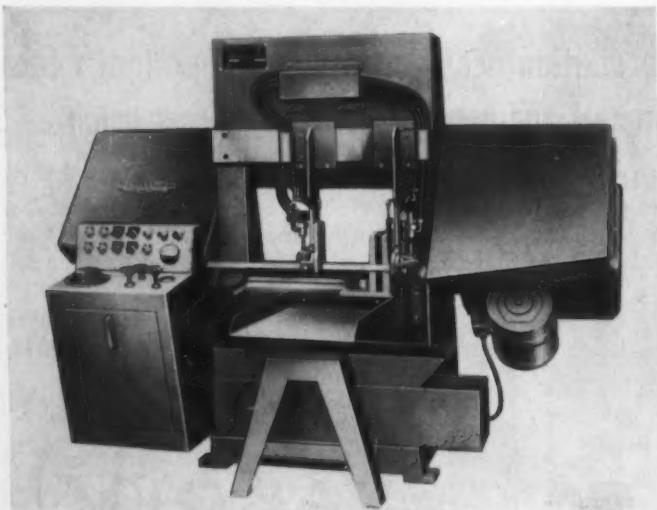
or carbon-steel cutting blades. Model Q-14 has a cutting capacity of 14 by 18 inches; Model QJ-24, 24 by 24 inches. Both machines are hydraulically and automatically operated. They feature

Wells' "twin column" construction, with the cutting head raising and lowering vertically for accurate horizontal blade action. They also feature a new self-contained, variable-speed drive unit which operates with conventional friction type speed changes. The operator dials the desired speed from 40 to 400 fpm. All controls are mounted on a stationary panel, easily accessible and safe for the operator.

All drive gears are completely enclosed in an oil bath. Large-diameter blade wheels (20 and 32 inches) minimize blade flexing for lower stress. Wells' exclusive ball-bearing, carbide blade guides require no stand-by set or setting gages. Quick-action vise effortlessly changes for up to 45-degree angle cuts.

Both machines are equipped with a 5-hp blade motor. Coolant capacity is 7 gallons. Q-14 weighs 2300 pounds; QJ-24 weighs 5000 pounds. Both can be equipped with Wells' recently introduced BF-24 automatic power feed unit.

Circle 601 on Readers' Service Card



Wells heavy-duty automatically operated metal-cutting band saw



HERE ARE PROGRESSIVE STEPS IN
THE EXTRUSION OF AN AUTO-
MOTIVE BEARING RACE

1. Slug starts as $\frac{3}{4}$ " diameter cut-off from coil stock.
2. Impacted to $1\frac{1}{16}$ " diameter.
3. Extruded to configuration.
4. Finished extrusion.

**"in COLD
EXTRUSION
SUCCESS DEPENDS
ON LUBRICATION"**

and success is yours

when you use

EXTRUDOIL #51 DO CONCENTRATE

MACCO EXTRUDOIL #51

DO CONCENTRATE

- REDUCES PRODUCTION COST . . . INCREASES PRODUCTION DUE TO LESS DOWN TIME BECAUSE OF TOOL CHANGES
- FREER FLOWING OF METAL ASSURES MAINTENANCE OF ABSOLUTE TOLERANCES
- CUTS INVENTORY COST — ONE LUBRICANT DOES ALL THE JOBS
- CUTS DIE TRY-OUT TIME

Why is Macco Extrudoil #51 DO Concentrate the first choice of experienced cold extrusion men? The answer is easy . . . Macco research and development, working hand-in-hand with leading extrusion equipment manufacturers, developed this Extrudoil to meet the distinct needs of cold extrusion. Result—today Macco Extrudoil #51 DO Concentrate is far ahead of the field . . . proved in production beyond question . . . used every day in the extrusion of screws, bolts, nuts, bearing races, spark plug shells, worm shafts, gears, tappet bodies, sleeves. If you are now engaged in cold extrusion, or even thinking about it, it will pay you well to talk to a Macco engineer. There's one in your area. If you don't know him, write, wire or phone us. We'll have him see you.

Get the facts . . . find out for yourself why

THE METALWORKING INDUSTRY LOOKS TO MACCO FOR LEADERSHIP

CLEANING COMPOUNDS
CUTTING LUBRICANTS



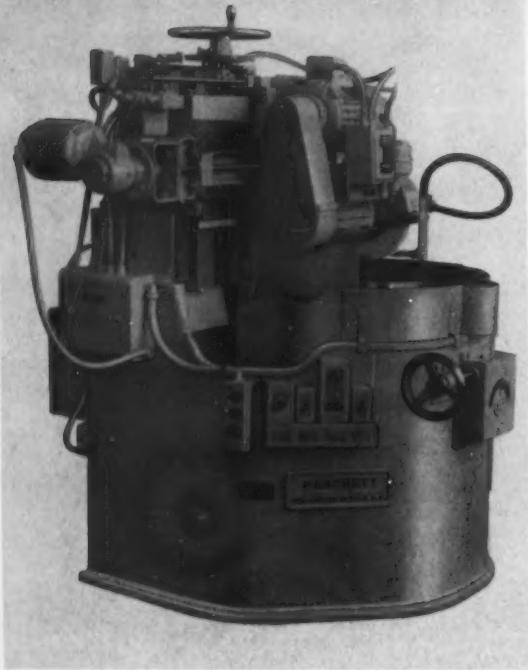
DRAWING COMPOUNDS
RUST PREVENTIVES
FORGING COMPOUNDS
EXTRUSION LUBRICANTS

MACCO
PRODUCTS COMPANY

CHEMICAL COMPOUNDS

FOR THE METALWORKING TRADE SINCE 1893

9205 W. S. SANGAMON ST., CHICAGO 20, ILLINOIS



SK-24 High Power slitter-knife grinder announced by the Hanchett Mfg. Co.

Slitter-Knife Grinding Machine

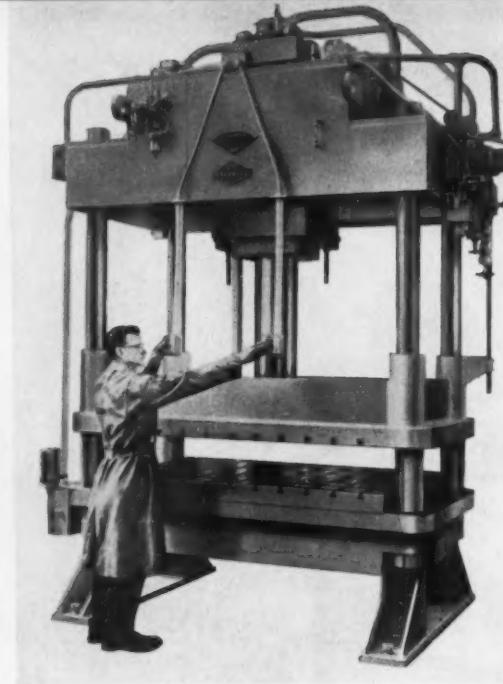
The Hanchett Mfg. Co., Big Rapids, Mich., has added to its line of SK-24 slitter-knife grinders a newly developed machine designed to grind knives which must be sharpened at high production rates while maintaining accuracy and a fine edge finish. Known as the SK-24 High Power, the grinder utilizes a 12-inch wheel mounted on a precision Pope spindle. The motor is a fully balanced, 3-hp model and has all supporting members made heavier to give adequate support to the larger grinding-head assembly.

Downfeed, cross-feed, and oscillation movements of the grinding head are each equipped with motor drive, and controls are fully automatic.

Circle 602 on Readers' Service Card

Greenlee B & T Hydraulic Trim Press

A four-bar trimming press, equipped with an adjustable deceleration valve and capable of exerting 100 tons of trimming stroke pressure, is announced by the B & T Machinery Co., Holland, Mich., a division of Greenlee



Hydraulic trimming press announced by B & T Machinery Co., division of Greenlee Bros. & Co.

Bros. & Co. This machine is designed to overcome the limitations of mechanically operated presses by utilizing hydraulic principles.

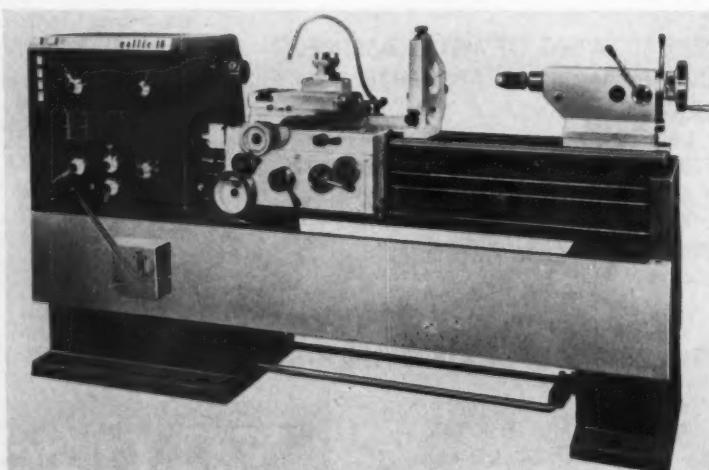
High-speed production results from the fast approach velocity of 900 ipm and a return speed of 875 ipm. The slow trimming action of 59 ipm produces neatly sheared, clean castings. Other features include a 36- by 72-inch die area, a supporting 52- by 88-inch base platen, safety stops on the tie-bars, and a 30-inch stroke.

Circle 603 on Readers' Service Card

"Mondiale" Engine Lathes

The Alina Corporation, Minneola, N. Y., is introducing a "Mondiale" line of precision engine lathes that includes five different models. These lathes are precision-built for sustained accuracy and top efficiency. Features include ruggedness, economy, functional design, easy operation, standard spindle nose, hardened and ground ways, and heavily ribbed bed.

Circle 604 on Readers' Service Card



Precision engine lathe of Mondiale line introduced by Alina Corporation



for Strength
... Economy
... Versatility

Tool Steel Topics



Seals for jet engine starter cartridges blanked with Lehigh H

The job was tricky. It involved cutting 6-in. circles from .002 in. Mylar, a plastic material used for vapor seals in jet engine starter cartridge parts because of its high strength and resistance to tearing. Bethlehem Lehigh H tool steel was selected by Seymour Manufacturing Co., Seymour, Indiana, who designed and built the die for Amoco Chemicals Corp. Lehigh H was a wise choice. The die,

made to extremely close tolerances, blanked the material cleanly, and produced nearly 140,000 pieces before slight redressing was required.

Lehigh H (AISI D-2) is our easy-machining high-carbon, high-chrome grade of air-hardening tool steel. It has high compressive strength, deep hardenability, and excellent resistance to wear.

Lehigh H has wide range of metal working uses

Because of its ideal properties, Lehigh H is used for blanking, forming, punching, shearing, bending, and other tool and die jobs. It's frequently used for rotary slitting cutters, wearing plates, and thread-roller dies.

Good things happen when you put Lehigh H on the job. Your local Bethlehem tool steel distributor can make prompt delivery.

Call him today for complete details.



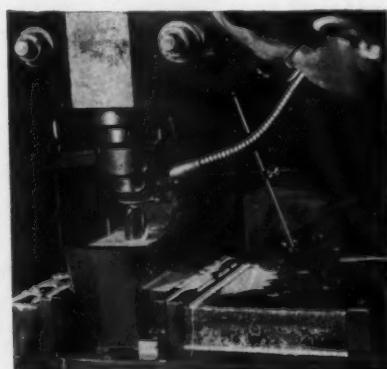
BETHLEHEM TOOL STEEL ENGINEER SAYS:

"Wear-In" of Tools Must Be Handled with Care



The initial use of new tools is the most critical period of operation. For example, during the "wear-in" period, the working surfaces of a drawing die and its mating punch may gall or "pick-up" portions of the metal being formed. This condition must be detected soon after it occurs, then removed promptly by hand stoning, to prevent further surface damage to the tools. If it is not detected and removed, heavy scoring and seizing may occur, producing not only short tool life but defective parts as well.

Obviously, the use of an effective lubricant will decrease "wear-in" problems, but even the best lubrication practice may not be sufficient protection on many operations. For example, a combination of tools and lubricant which performs well in processing soft steel may be troublesome in working stainless stock. Close attention to such tools during "wear-in" will delay the "wear-out" period.



Air-4 Tool Steel Machines with Ease.

Bethlehem Air-4 is a medium-alloy tool steel which hardens in air at 1550 F. It has excellent free-machining characteristics, due to a carefully controlled addition of lead. Air-4 also has plenty of wear-resistance, toughness, and deep-hardening properties. It can also be heat-treated without running any danger of cracking.

Handymill Equipped with Both Rail and Side Head

The Handymill budget-size milling machine recently introduced by the G. A. Gray Co., Cincinnati, Ohio, is now available with two milling heads at a cost said to be far less than that of conventional millers equipped with one head. This machine is designed to increase production and reduce setup time in production work, as well as ordinary shop jobs in the metalworking industry.

The milling heads are square-locked to the rail or side on non-metallic bearing ways, assuring the rigidity essential to carbide milling. The 10-hp milling heads feature a totally enclosed fan-cooled, alternating-current motor with a smooth positive cog belt. The motor drives a four-step pulley to the spindle drive. The spindle drive consists of a two-speed balanced planetary gear system which is self-oiled. Eight speeds are available ranging from 67 to 652 rpm. Large spindle bearings permit heavy cuts with a No. 50 N. S. taper in the nose. Standard right-angle attachments can be used.

Circle 605 on Readers' Service Card



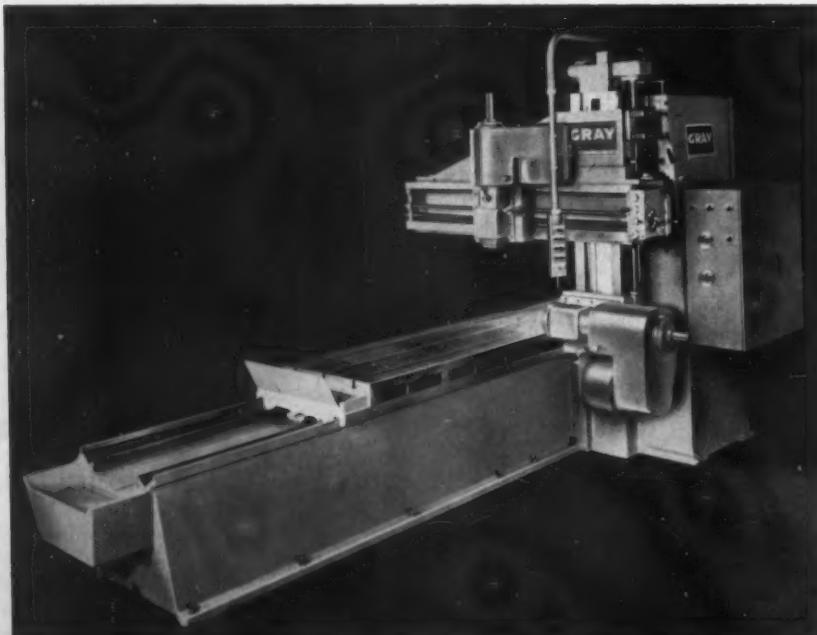
Metco powder flame guns metalizing sheet mill carrier rolls

Powder Flame Guns for Metalizing Carrier Rolls

A ceramic coating, in this case alumina, is being applied to a steel-sheet mill carrier roll by two powder flame-spray guns manufactured by Metco Inc., Westbury, N. Y. Using the two guns serves to speed up the work. Nichrome

rolls previously used picked up scale which damaged following sheets. The alumina-clad rolls, which are unfinished but sealed, are said to be doing an excellent job and show no scale pickup.

Circle 606 on Readers' Service Card



G. A. Gray Handymill available with both rail and side head



THE BEST THINGS IN TOOL LIFE ARE FREE

Utilization of machines, not conservation of cutting tools, is the way to find cost-free savings in the shop. Operating machines slowly to get long tool life is like "saving string." Speed determinations, based on total cost accounting (not machinability tables), go beyond smoke and blue chips to the unexplored opportunities in machine utilization. Real savings, today come from faster machine speeds and more efficient tool changing . . . to increase profit yield from a machine investment and boost productivity of people. They come big and easy from accurate presetting of tools and "packaged setup." To reduce downtime. To eliminate scrap . . . to shorten lead time and reduce parts inventories. Scully-Jones offers complete tooling SYSTEMS to help you develop these opportunities from existing capital and manpower. Tooling systems for transfer machines, multiple spindle automatics, single-spindle chuckers, radial drills, and others. Your Scully-Jones representative offers application ideas and complete information on quick-change, quick-set tooling. Phone him or write the factory.

Scully-Jones and Company
1906 South Rockwell Street, Chicago 8, Illinois

**SCULLY
JONES**

**QUICK-CHANGE
QUICK-SET TOOLING**



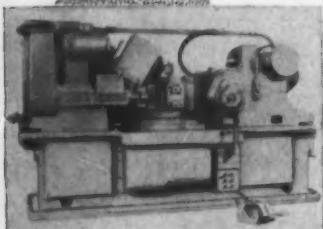
Hannifin Industrial Utility Presses

A new line of hydraulic ram type or guided-platen Series I industrial utility presses has been announced by the Hannifin Co., Des Plaines, Ill., a division of Parker-Hannifin Corporation. These presses feature a "component selection" concept which makes possible a broad choice of standard frames, working forces, speeds, circuits, controls, and power sources. They can be designed for specialized production jobs by simply selecting the proper combination of standard components to meet preset requirements.

The presses have structural steel frames which meet NMTBA deflection standards and are available in 25-, 50-, 75-, and 100-ton capacities. They are made in both ram type and guided-platen models with a die area of 24 by 24 or 36 by 24 inches. Seven power sources are available to provide a wide range of press speeds. Seven electrical control systems, as well as manual control and patented sensitive pressure control, can be furnished. This line of presses was designed to permit a wide variation of choices from basic components, thus making available a "custom" design at a low price.

Circle 607 on Readers' Service Card

GOSS and DE LEEUW AUTOMATIC CHUCKING MACHINE



*means a complete piece . . .
at each index cycle*

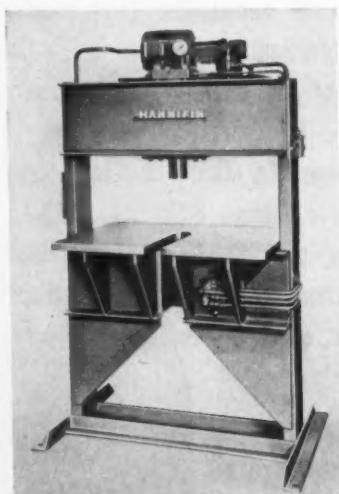
When a piece is finished it is completely finished without the necessity of a second operation. Furthermore it means more finished pieces in a given period of time and greater accuracy in every finished piece.

The "1-2-3" Method is exclusive with Goss & De Leeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

*Send for illustrated literature giving detailed information.
Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine*



**GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.**



Hydraulic press of new line announced by the Hannifin Co.

TIPS

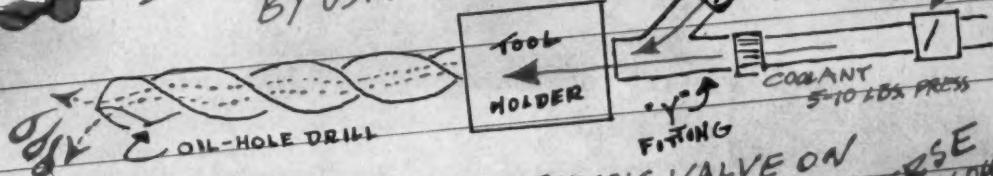
from a toolmaker's notebook

Problem -

*9/18
George N. called*

CHIPS CLOGGING OIL HOLE DRILL FLUTES

*Solution - BOOST COOLANT INTO DRILL
BY USING AIR PRESSURE*



USE Y-FITTING. CHECK VALVE ON
COOLANT LINE WILL PREVENT REVERSE
FLOW.

*Mom
Send this
to George*

It's the business of engineers at Chicago-Latrobe

to solve metal-cutting problems. Whether it's a case like the one above or a sophisticated setup involving tape control, C-L is certain to have experience that can save you time and money.



Begin the contact by calling in your local C-L Distributor or C-L Sales Engineer

...or by writing Chicago-Latrobe

direct...do it today.

Do you have a C-L catalog?

It is free on request.

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CHICAGO 10

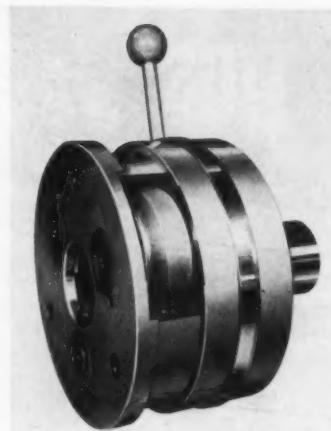
Landis Thread-Rolling Head

A 2-inch thread-rolling head has been designed by the Landis Machine Co., Waynesboro, Pa., for rolling threads in diameters of 1 1/4 to 2 inches UNF and UNC (right- and left-hand). This No. 16 head is available in both stationary and revolving models. It increases the Landis line of thread-rolling heads to five sizes covering a diametrical range of 1/4 to 2 inches. The revolving model is for application to threading machines and automatic screw machines

using a revolving tool, while the stationary head is designed for turret lathes, hand screw, and automatic screw machines using a stationary tool.

Both styles are self-opening in operation. The stationary head is opened by interrupting the forward travel of the turret or carriage; revolving head, by interrupting the forward travel of the yoke. Closing of the stationary head is by a reset handle, while the revolving head is closed by a yoke.

In operation, the use of lead-



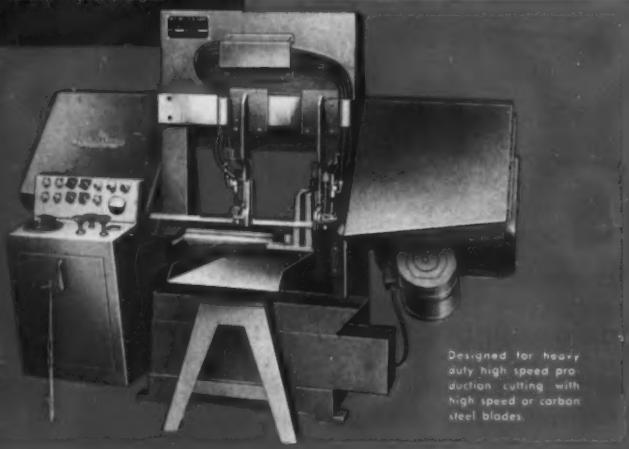
Thread-rolling head announced by Landis Machine Co.

**BRAND
NEW** from
blade to base!
PREMIUM THROUGH
AND THROUGH!

W. F. WELLS & SONS, INC.

Models Q-14 and QJ-24

METAL CUTTING BAND SAWS



Designed for heavy duty high speed production cutting with high speed or carbon steel blades.

- NEW! Big J vibration-free twin-column construction. Entire cutting head raises and lowers vertically for absolute horizontal blade action.
- NEW! Self-contained variable blade drive, no friction-type changes. 40 to 400 F.P.M.
- NEW! Fully automatic hydraulic operation. All controls are mounted on a stationary panel, easily accessible and safe for operator.
- NEW! Large diameter blade wheels for less flexing stress.
- NEW! Exclusive ball-bearing carbide blade guide. No stand-by set or setting gauges required!
- NEW! Quick-action vice effortlessly changes for up to 45° cuts.
- NEW! Automatic bar feed available.
- NEW! Dozens more exclusive and patented features!

S P E C I F I C A T I O N S

	Model Q-14	Model QJ-24
Capacity	14 x 18	24 x 24
Blade Motor	5 H.P.	5 H.P.
Pump Motor	1 1/2 H.P.	1 1/2 H.P.
Blade Speed	40-400 FPM	40-400 FPM
Blade Size	1 1/2" x 14 1/2"	1 1/2" x 21 1/2"
	x .035	x .042
Coolant Capacity	7 Gal.	7 Gal.
Coolant Pump Capacity	330 GPH	330 GPH
Weight	2300 Lbs.	5000 Lbs.
Band Wheel Diameter	20"	32"

W. F. WELLS & SONS, INC.
ONE U.S. 131, North, Three Rivers, Michigan

WANT TO KNOW MORE?
Your request for new literature
will receive prompt attention.

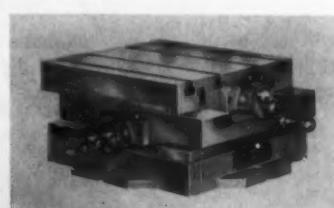
screw, cam, or positive feed with these heads is not recommended. The necessary leading action is developed by the thread rolls mounted on roll shafts inclined to the proper helix angle. The roll shafts are inclined through replaceable helix-angle bushings.

Changes in diameter and/or pitch are effected by installing the proper thread rolls. Size adjustment can be accomplished by means of two opposed set-screws in the adjusting ring.

Circle 608 on Readers' Service Card

Troyke Precision Auxiliary Table

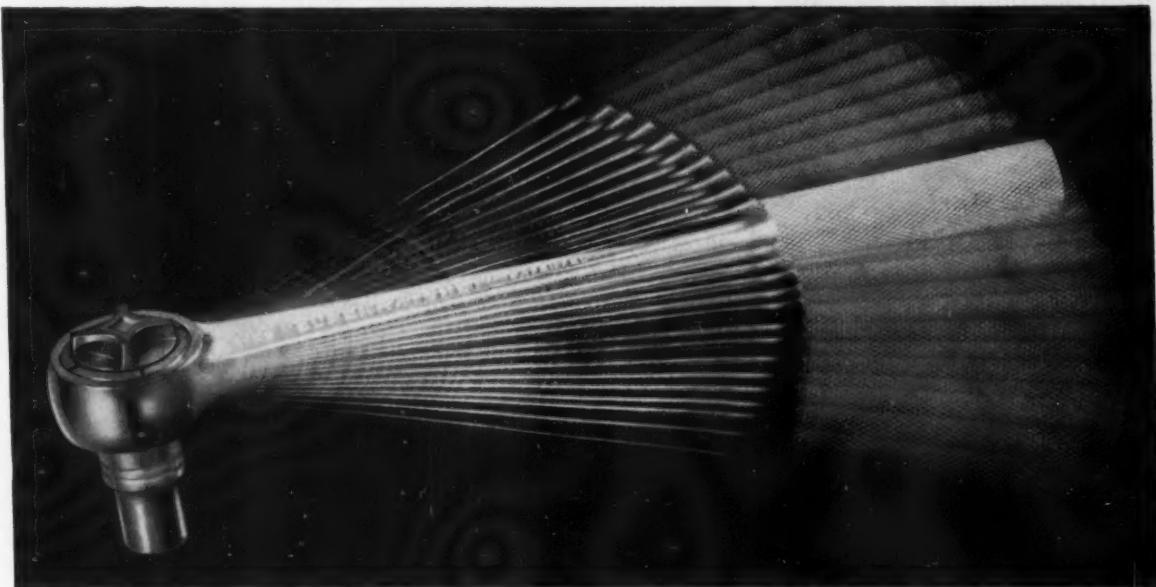
The Troyke Mfg. Co., Cincinnati, Ohio, has announced a Model CS-12 cross-slide table for use in precision positioning on X and Y axes. This auxiliary table can be used in conjunction with standard rotary tables, mounting it above or below, to obtain X, Y, and rotary motion. It has a 12-by 12-inch working surface, affords 10 inches of travel on each



Precision cross-slide table announced by the Troyke Mfg. Co.

Get the swing

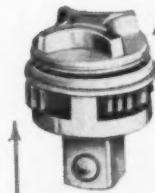
with WILLIAMS $\frac{3}{8}$ " and $\frac{1}{2}$ " diameter SUPERRATCHETS®.
Complete nut rotation requires less than $4\frac{1}{2}^{\circ}$ swing.
Long handle is proportioned for ideal balance, comfort and leverage.



Get the features Modern design and manufacture combine to produce a ratchet 50% stronger than U.S. Government requirements with these quality features:

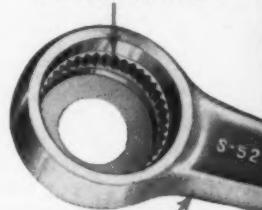
Get the flexibility 88 Drivers and attachments in $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1" drive sizes, plus 254 sockets, offer endless combinations to solve any nut-turning problem.

SINGLE UNIT CONSTRUCTION.
EASILY REMOVED FOR CLEANING AND SERVICING.

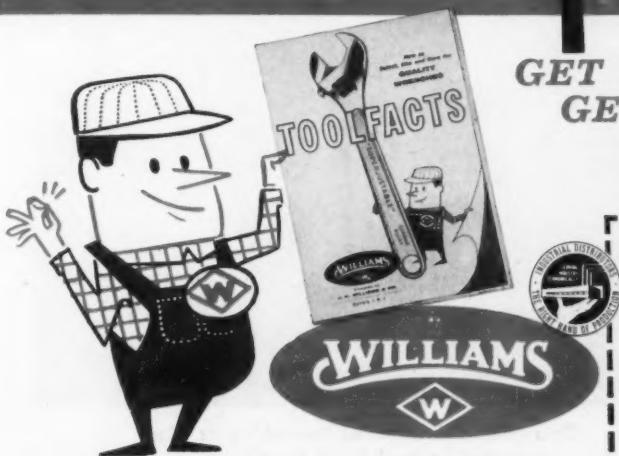


STRESSES EVENLY DISTRIBUTED
THROUGHOUT ENTIRE MECHANISM.

41 TEETH GIVE
82-TOTH ACTION



THE HARDER THE PULL ON THE
HANDLE, THE MORE TEETH THAT
COME IN CONTACT.



GET THE FACTS... GET TOOLFACTS... MR. WRENCH

suggests that you send for this New 24-page booklet on How to Select, Use and Care for Quality Wrenches.

J. H. WILLIAMS & CO., 409 VULCAN ST., BUFFALO 7, N.Y.
Division of United-Greenfield Corporation

Mr. Wrench: Please send me your new

TOOLFACTS Booklet ILLUSTRATED CATALOG No. 304

NAME _____ TITLE _____

FIRM _____

STREET _____

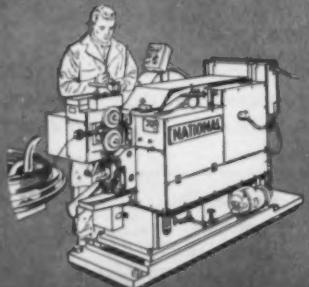
CITY _____ ZONE _____ STATE _____



National High Speed Cold Headers make these interesting odd-shaped parts at the highest safe speeds ever achieved. (450 per minute in the $\frac{1}{8}$ " size).

These jobs and others are cold-forged scrapless from wire in this rugged, efficient new family of National Headers.

Do you make or use metal parts in quantity? We welcome you to Tiffin for actual machine demonstrations and a thorough study of your header needs.



NATIONAL MACHINERY CO.

TIFFIN, OHIO, U.S.A.
HARTFORD DETROIT CHICAGO

Circle page number on Readers' Service Card

206

slide, and features hardened and ground Acme feed-screws mounted on tapered roller bearings and running in bronze nuts that are adjustable.

Accuracy is within 0.001 inch in the full 10 inches of cross-slide travel. Other features include tapered gibbs, adjustable quick-set

dials accurately graduated in 0.001-inch increments, stainless-steel scales graduated in 0.100-inch increments, gib locks on the cross-slides, and stops on each cross-slide for use with gage-blocks or length gages. All surfaces are precision-ground.

Circle 609 on Readers' Service Card

Reed Through-Feed Thread- and Form-Rolling Machine

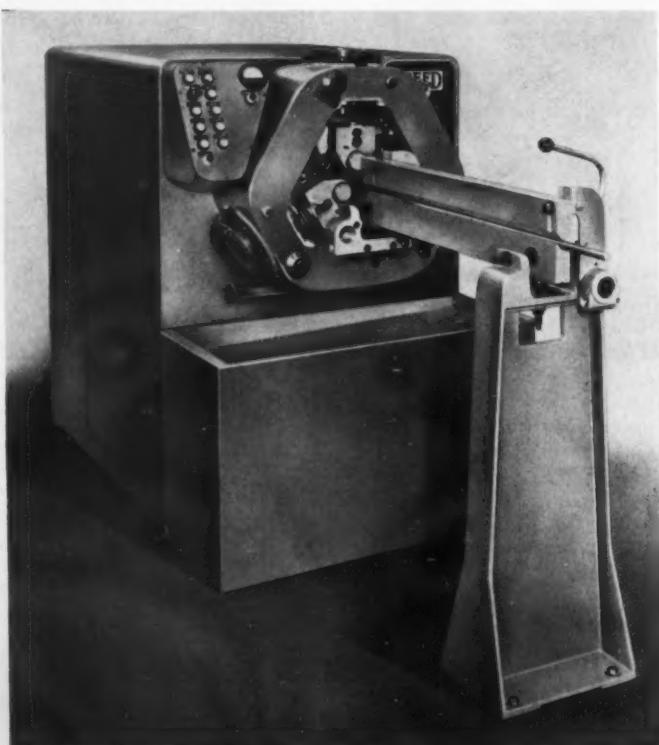
A Model A25 machine has been developed by the Reed Rolled Thread Die Co., Holden, Mass., for through-feed thread and form rolling. The adjustable die-holders of this machine remain in the rolling position for continuous through-feed threading of long or short work. For through-feed rolling of work with shoulders, a hydraulic system is available for retracting the dies to permit returning the work to the front of the machine for unloading.

Unit construction permits this machine to be furnished with a variety of tooling for specific applications, as well as general-purpose threading. The Reed three-cylindrical-die through-feed

principle of rolling is employed, using dies set at either parallel or skewed axis. This provides self-centering of the work between the three dies, eliminating the need for separate equipment to position and support the work relative to the axis of rolling.

The triangular stress system provides capacity for rolling loads up to 30,000 pounds, insuring stability and uniform size control. Threads and forms from $1/2$ to $2 \frac{1}{2}$ inches in diameter are rolled in aluminum, brass, stainless steel, and a wide variety of alloy and heat-treated steels.

The machine has a 15-hp motor. Eight standard die speeds from 105 to 695 rpm provide production



Through-feed thread- and form-rolling machine developed by Reed Rolled Thread Die Co.

SINGER^{*} NUMERICAL CONTROL

BUY THE COMPLETE PACKAGE . . . For the O.E.M., SINGER Numerical Control is the most direct approach to point-to-point positioning. It offers speed, capacity, versatility, and high accuracy, and is available at a low initial investment. The system is sold as a package, complete and ready for installation, including the tape reader. It requires only the measuring bars to suit the specific machine. SINGER Numerical Control offers a high degree of accuracy for drilling, jig boring or milling . . . $\pm .001$ inch as standard or $\pm .0002$ when required on work tables up to 40 inches in size. . . . **OR AUTOMATIC POSITIONING . . .** For the buyer who wants to acquaint himself with the advantages of automatic positioning with end measures, rather than buy a complete Numerical Control package, our system is ideal. Because of SINGER'S modular design, a machine can be furnished with the automatic positioning system only. At a later date, the tape portion of the system can be readily added with no sacrifice of the original investment. It is important to know, too, that all modules and motors are designed, serviced and built by Diehl Manufacturing Company, a SINGER subsidiary. Call or write for an appointment at the address below.



DIEHL MANUFACTURING COMPANY

SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY • Finderne Plant, Somerville, New Jersey • Telephone: Randolph 5-2200

*A Trademark of THE SINGER MANUFACTURING COMPANY
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Winter Brothers fluteless 'Rocket' Taps produce superior threads in materials such as aluminum, brass, copper, ductile steel and die castings by chipless forming, rather than by cutting. Because these taps actually displace metal without removing it, no chips are formed to clog flutes and cause tap breakage. Resharpening is virtually eliminated; longer tool life is assured. Formed threads are extremely accurate, have an excellent burnished finish and offer maximum strength.

'Rocket' Taps are stocked by your local Winter Distributor. Call him today for complete information. Or, write for our free, informative brochure on 'Rocket' tapping.

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
CHICAGO • DALLAS • SAN FRANCISCO • LOS ANGELES



Choose from
Winter's Wide Line of
Taps, Dies and Gages

CALL YOUR WINTER DISTRIBUTOR

rates of approximately 6 ipm to over 300 ipm. Standard work-handling equipment suitable for a wide range of applications is available for manual, semiautomatic, or completely automatic operation.

Circle 610 on Readers' Service Card

Brown & Sharpe Coolant-Supply Units

The Brown & Sharpe Mfg. Co., Pump Group, Providence, R. I., has announced two low-price tank and pump units designed to supply coolant to machine tools. The



Coolant-supply tank with 1/8-hp pump announced by the Brown & Sharpe Mfg. Co.

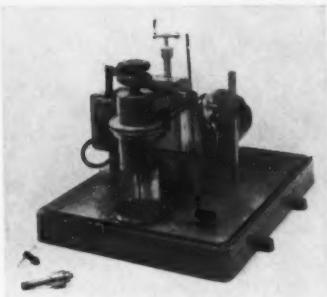
tanks are 16- and 32-gallon capacity with two baffles to aid in settling chips and sludge. Welded-steel body and cover provide rigid assembly. The units are also available with either swivel casters or welded-steel legs.

The tanks are equipped with the 1/8-hp Brown & Sharpe Midget Hi-Flo centrifugal pump, which circulates a copious flow of water-soluble coolant or cutting oil up to 300 SSU viscosity. Volumes of 20 gpm at 7-foot head or 10 gpm at 14-foot head are provided by this pump unit. Pump motors are available for standard electric current ratings.

Circle 611 on Readers' Service Card

Micro Drill Press

F. W. Derbyshire, Inc., Waltham, Mass., has announced a new-design micro drill press for precision drilling of small, fine holes. The press has a throat depth



Fine-hole drill press announced by
F. W. Derbyshire, Inc.

of 4 1/2 inches, and the spindle, which slides in sleeves, has a travel of 1 1/4 inches. The column has a micrometer screw and can be adjusted over a range of 2 inches in increments of 0.001 inch. Powered by a 1/12-hp motor, the press takes standard Magnus-Elect collets in sizes from 0.004 to 0.315 inch. Special accuracy (0.0001 inch) collets can also be supplied. The press has finger-touch control designed to afford more sensitive drilling of small parts.

Circle 612 on Readers' Service Card

Auto-Collimator Designed to Measure Two Planes Simultaneously

A universal microptic auto-collimator has just been announced by the Engis Equipment Co., Chicago, Ill. This instrument, the TA-51, permits direct reading of horizontal and vertical planes simultaneously to 0.1 second over a



Engis auto-collimator that measures in two planes simultaneously

range of 10 minutes of arc. The illuminator and micrometer units of this instrument are interchangeable and can be assembled for straight or right-angle viewing. A new, larger objective lens produces improved definition and working distances to 100 feet. The

Quick-Change Detachable Heads, an exclusive, patented feature of National Gun Drills offer maximum production economy, assure less drilling downtime. Available on both Center-Cut and Target type Gun Drills larger than 17/32" in diameter, the Quick-Change design allows resharpening or replacement without removing the drill shank from the machine.

Target Gun Drills permit straighter, deeper drilling to closer tolerances. A solid core is formed that acts as a continuous center guide in the hole being drilled with a resulting increase in accuracy.

Center-Cut Gun Drills are recommended for peak efficiency on certain applications such as blind-hole and interrupted-hole drilling. Call your National Distributor for complete information. Or, write for our Gun Drill Manual.

NATIONAL TWIST DRILL & TOOL COMPANY

Rochester, Michigan, U.S.A.

DISTRIBUTORS IN PRINCIPAL CITIES. BRANCHES IN NEW YORK
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National's Parade of
Plus Products

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Model TA-50 auto-collimator has the same features except that it views two planes individually, without rotating its tube.

These two new instruments, like other microptic auto-collimators, function independently of distance and temperature under normal conditions. They are standard for establishing squareness, parallelism, flatness, angles, circular spacing—for testing surface plates, machine tool alignment, gear-cutting devices, circular tables and dividing heads.

Circle 613 on Readers' Service Card

Thread Pitch-Diameter Comparator

An indicating pitch-diameter comparator, combined with three-wire carriers designed for rapid, accurate measuring of pitch diameters, has been announced by the Standard Gage Co., Inc., Poughkeepsie, N. Y. This comparator is manufactured to comply with the Federal Government's H-28 specifications.

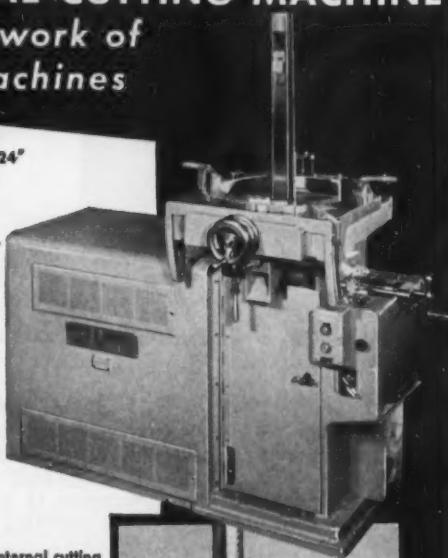
The conventional hand-held measuring wires are placed in indi-



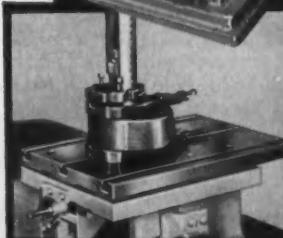
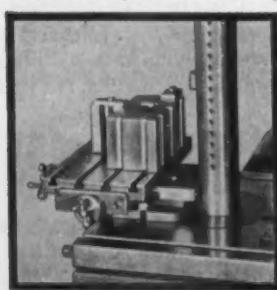
Pitch-diameter comparator made by Standard Gage Co., Inc.

AMAZING NEW HYDRAULIC M & M KEYSEATER AND VERTICAL CUTTING MACHINE does the work of many machines

In addition to a keyseater that cuts internal keyways up to 3" wide x 24" long, the new hydraulic M & M is a handy tool room machine and can be easily adapted to special production jobs other than keyways. A wide variety of internal or external cuts, serrations, grooves and teeth can be rapidly made on this machine. With a combination tilting table and index table (shown on machine at right) straight or tapered bores and accurately spaced multiple keyways or splines may be cut at any degree of the circle. Send us prints of your cutting problems.



Right: Set-up for internal cutting
Below: Set-up for external cutting



BUILDERS OF MACHINERY SINCE 1854

M & M KEYSEATERS AND VERTICAL CUTTING MACHINES

MITTS & MERRILL • 64 Holden St. • SAGINAW, MICHIGAN

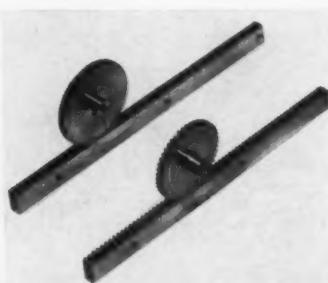
106

vidual carriers for greater handling ease and longer life. Available in three sets—"N," "P," and "NQ"—they are designed for use on micrometers and measuring machines, as well as the new comparator illustrated. The comparators can also be used to measure the pitch diameters of gears and regular outside diameters with an adjustable range from 0 to 1 1/16 inches.

Circle 614 on Readers' Service Card

Pic "Certified" Precision Racks

Two high-accuracy racks from a complete line of "Certified" precision spur gear racks in 24-, 1/10-, 32-, 48-, 64-, 72-, 80-, and 96-diametral-pitch sizes now offered



from stock by the Pic Design Corporation, East Rockaway, N. Y. Manufactured from No. 416 stainless steel under controlled stress-relieving procedures before final



Take a
U.S. Universal
Adjustable
Drill Head

... equip it with slip spindles, and a jig-bored slip spindle plate for every production hole-pattern job you have (or want) within the capacity of the head;

... for each long-run, complicated or multi-piece setup, use a plain or indexing holding fixture and guide bushing plate;

... for short runs, merely locate the standard adjustable arm brackets quickly and accurately with a bushing plate.

Do this with as many different size U.S. Drill Heads as you need to cover the entire range of multiple hole work in your shop.

You now have possibilities unlimited for lowest cost per drilled hole! And, if your machines have a reversing spindle, you can *drill and tap with the same head!*

Check these possibilities on your jobs . . . call your U.S. Drill Head Representative, or contact us direct.

*For descriptive data,
ask for Catalog AD-57.*



Style U-2 Head drilling housing flange.
Inset shows "tool crib" of drills and
slip spindle plates used with this
head on 17 other setups.

U.S. Universal Heads are built in 8 models, 6 to 12 spindles, 6" to 15" drilling areas, $\frac{1}{4}$ " to $1\frac{1}{4}$ " capacities. Positive drive, hardened shaved gears, super finish spindles, heavy-duty lifetime-lubricated joints.

possibilities unlimited

for lowest cost
per drilled hole!



UNITED STATES DRILL HEAD CO.

5298 River Road • Cincinnati 33, Ohio



Adjustable and Fixed Center Multiple Drilling Heads —
Individual Lead Screw Multiple Tapping Heads — and Fixtures.

cutting, the new racks are subject to minimum distortion or growth due to shelf life or temperature variations. Rack dimensions are "certified" at final inspection, and a complete inspection report is supplied with every rack. Standard 11-inch lengths, precision-ground on all sides, are available in Pic Precision 1, 2, and 3 classifications. With ends ground to 1/2 linear pitch, rack may be butted where greater lengths are required.

Circle 615 on Readers' Service Card

Kennametal Semifinished Boring-Bars

Semifinished boring-bars, consisting of solid tungsten-carbide shanks with heads made of machinable steel for mounting a variety of cutting tools, introduced by Kennametal Inc., Latrobe, Pa. Called semifinished K-bars, the Kennametal shanks are designed to reduce chatter and minimize deflection. The tool-holding steel heads, brazed on the shanks, are large enough to



accommodate any tooling that would be used on each size of bar. Available tooling includes the new Kendex adjustable units and tooling of other manufacturers. Mountings may be machined by the user, by Kennametal, or by other tool manufacturers. Ten sizes of semifinished K-bars, ranging from 7/16 to 2 1/2 inches in bar diameter and from 7 5/8 to 28 1/4 inches in over-all length, are available. Heads made of 28-32 Rockwell C steel are 3/4 to 4 5/8 inches in diameter and 1 15/16 to 9 5/8 inches long. Bars of 3/4-inch shank diameter and larger have coolant holes through their centers.

Circle 616 on Readers' Service Card

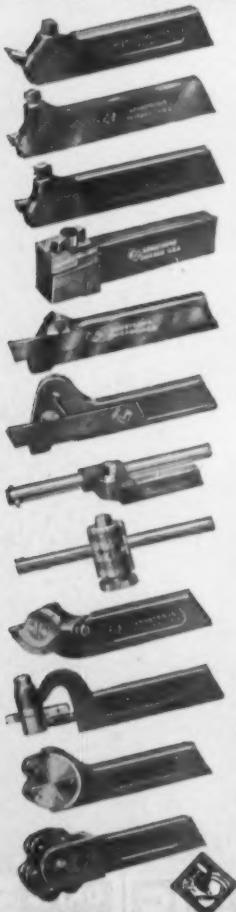
ARMSTRONG TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with adequate numbers of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for every standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

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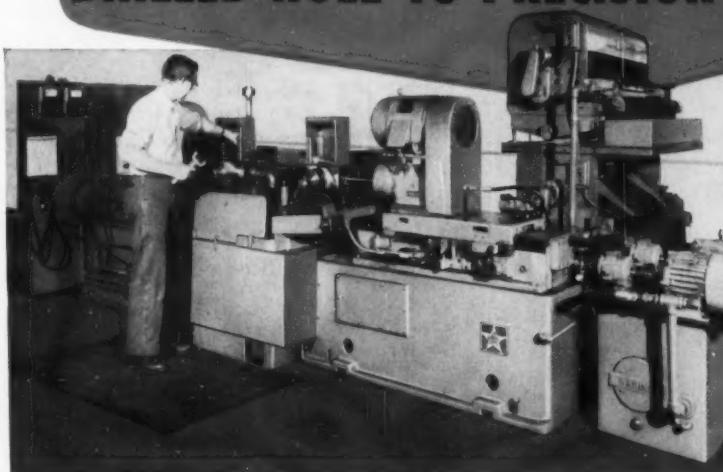
Airco Single-Stage Industrial Gas Regulators

A new series of all-purpose, single-stage industrial gas regulators featuring inverse type seal design announced by Air Reduction Sales



Co., a division of Air Reduction Co., Inc., New York City. These Airco 9100 series oxygen and acetylene regulators are designed

Star "REBUILT" EQUIPMENT GIVES YOU LOW-COST HOLE FINISHING— FROM SOLID, CORED OR PRE-DRILLED HOLE TO PRECISION SIZE AND FINISH-



Show here are a few examples of Star "rebuilt", with Star-bore tooling, that are making money for their owners.

Star's master machinists will rebuild your present equipment, (or a modern Machine from our stock), to your specification, and with a NEW MACHINE GUARANTEE!

You too can save equipment outlay, improve your competitive position and boost your profits with equipment rebuilt by Star, the precision hole drilling and reaming specialists.

Let us give you an estimate!

Starbore tooling gives you—

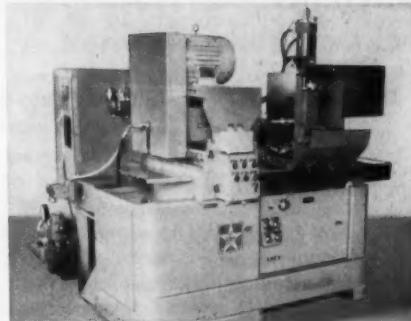
- ★ LONGER TOOL LIFE
- ★ REDUCED NUMBER OF OPERATIONS
- ★ CLOSER TOLERANCE
- ★ IMPROVED FINISH



Designed for smooth precision drilling of blind or intersecting holes, cored areas, laminated sections or recesses. Off-center pressurized coolant port produces no pin.

in one operation!

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DRILLS, GUN DRILLS AND
PRESSURE COOLANT REAMERS.



Starbore TWO-FLUTE, MULTI-DIAMETER REAMER

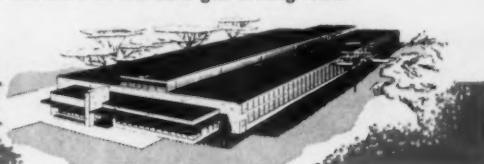


Patent No. RE-24769

In many cases these high precision tools can ream a die cast or rough-cored hole to a highly accurate, finished, stepped hole in one operation. Note ample purging action of pressurized coolant.

Write for detailed literature on Starbore gun drilling tools.

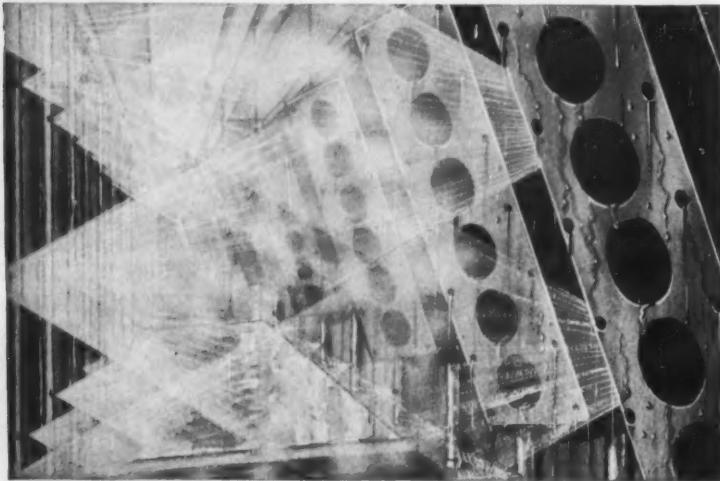
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- Metal chips wash away under its action.
- When dry it leaves a protective film that prevents the rusting of machined or ground parts prior to assembly—yet it doesn't affect accurate gauging.

Now largely used in automotive plants, Oakite 198 is proving its economy as well as its unique effectiveness in providing fast, smut-free cleaning plus rust protection. It works in single or multistage machines, at economical concentrations.

Oakite 198 is just one of a complete line of Oakite materials for machine cleaning. There are non-foaming solvent agents for heaviest duty cleaning, alkaline cleaners for removing moderate to light soils. When you ask Oakite you can be sure of getting a cleaning compound designed to give you best possible results, designed to reduce your "per unit" cost. You can be sure, too, of getting prompt, intelligent in-plant service from your local Oakite man.

Send for Bulletin. Oakite Products, Inc., 26 Rector Street, New York 6, N.Y.

it PAYS to ask Oakite

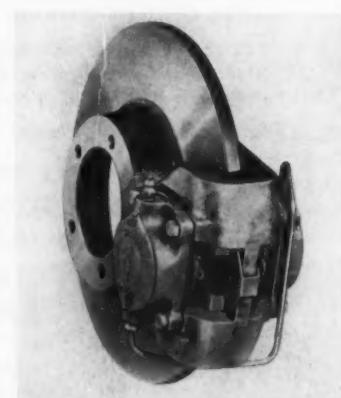


to provide slightly rising delivery, or work pressure, as cylinder pressure falls off. This makes possible lower residual pressures at cylinder and other points than is attainable with a conventional single-stage regulator. Through a unique diaphragm design, excellent performance of a large diaphragm area is provided without making the regulator body excessively large. These regulators are available in five models for use in welding, cutting, brazing, and heating operations.

Circle 617 on Readers' Service Card

Fawick Caliper Disc Clutches and Brakes

Caliper type disc clutches and brakes will be manufactured and sold in this country by the Fawick Airflex Division, Fawick Corporation, Cleveland, Ohio, under a licensing agreement with the Dunlop Rubber Co., Ltd., England. These units have been proved in severe braking applications on industrial and automotive equipment. They are designed to meet



requirements for powerful clutching or braking in a wide range of modern machinery. Balanced action is obtained by the opposed piston design of the Dunlop caliper, which applies pressure equally on opposing friction shoes, thus producing balanced loading on the disc. This arrangement permits both the caliper and the disc to be fixed and eliminates the need of floating either component. Automatic self-adjustment is provided by a retractor-pin assembly which guarantees uniform clearance be-

DATA

6 units with 34 spindles
24-inch index table
7 work fixtures (double chucking)
80-inch base
400 parts per hour gross



Kingsbury machine performs 34 operations for Kelvinator International overseas

Double chucking makes possible operations on both sides of plate

This horizontal index machine shows how a high production Kingsbury combines a lot of operations to cut costs.

It cuts labor costs. One operator and one machine produce 400 good parts per hour because this special purpose Kingsbury performs 34 operations. Several general purpose machines couldn't give as low a unit cost.

It saves space. One Kingsbury often takes less floor space than a single general purpose machine, though it combines the operations of many.

It cuts work-in process inventory. By combining operations it eliminates the bank of parts in front of each machine necessary with one-at-a-time operations.

It cuts maintenance costs. Good basic design and rugged, accurate construction mean a Kingsbury will run through millions of cycles without serious trouble. Fewer machines save repair parts and labor.

Each work fixture shown here holds two parts, one in the first chucking and one in the second. The first is near the top, where the part is located by its contour. The second is on the bottom, located over pins that enter two holes

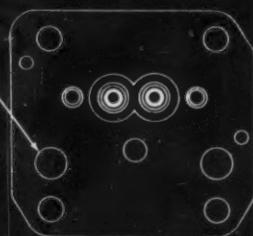
reamed in the first chucking. Both chuckings are proofed to prevent incorrect loading.

Perhaps we could help you get more good parts per hour. For more information ask our representative to call. His name is in Thomas' Register and other directories. Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY

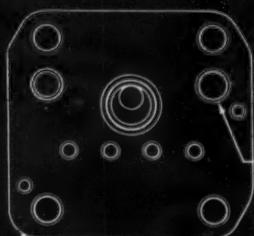
1st Chucking

DRILL - 13 HOLES
REAM - 2 HOLES
C'SINK - 2 HOLES
COMB. C'DRILL & TREPAN - 2 HOLES



2nd Chucking

COMB. C'DRILL & TREPAN
C'SINK - 4 HOLES
REAM - 2 HOLES
CHAMFER - 8 HOLES



STEEL VALVE PLATE FOR COMPRESSOR

COSTS UP?

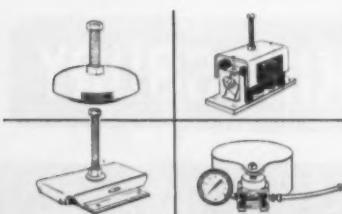
MACHINES TIED DOWN?

Plant moves, rearranging layouts, new machine installations all cost money — and the cost is excessive if you make a practice of lagging your production equipment to the floor.

Wouldn't it save money in your operation if you could forget about spotting, drilling, shimming, lagging and all the other costly necessities that go with tying down machinery? By using BARRY MOUNTS® you eliminate those expenses and repeat your savings whenever you relocate a machine.

Barry offers three different resilient elements: neoprene, helical springs or air to solve your individual requirements. These quality-engineered Machinery Mounts not only provide the ultimate in layout flexibility — they pay big dividends too — isolating shock and vibration, improving precision, reducing machine and building maintenance. Even operator efficiency goes up as noise levels come down.

If you want to add cost-saving efficiency to your operation — look into a BARRY-MOUNT® program. Write for Bulletin 60-04C, "Practical Considerations When Installing Machinery."



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Division of Barry Wright Corporation

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1400 FLOWER ST., GLENDALE, CALIF.

Circle page number on Readers' Service Card
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tween friction shoes and disc throughout the life of the friction lining. Currently available models with single calipers have maximum torque ratings from 9700 to 54,300 inch-pounds at 1000 psi.

Circle 618 on Readers' Service Card

NEW PRODUCT BRIEFS . . .

CONVEYOR LINE of automatic vibrating type incorporating a series of individual feeders which clean, treat, and rinse small parts as they move through the production line. This equipment, brought out by the Cleveland Vibrator Co., Cleveland, Ohio, cannot be damaged by dust, water, many chemical solutions, or fine vapor. The complete series of feeders carries the parts approximately 21 feet through the washing and rinsing process before discharging them, ready for the next production operation.

Circle 619 on Readers' Service Card

MELTING AND HEATING POWER CONTROL UNIT of motor-generator powered, high-frequency induction type announced by Inductotherm Corporation, Rancocas, N. J. This 20-kw unit, called the Inducto Integral 20, is completely self-contained and designed for use in research and development laboratories, as well as in small foundries. It occupies less than 10 square feet of floor space; yet it contains everything necessary for operation of either of two induction-melting furnaces or heating coils.

Circle 620 on Readers' Service Card

CARBIDE BAR TURNER, the first of a new line of Medart high-speed centerless bar- and tube-turning machines designed and built by the Blaw-Knox Co., Pittsburgh, Pa., especially for the use of carbide and ceramic tooling. This machine is equipped for feed rates up to 60 fpm on the smaller sizes and to 30 fpm on larger sizes. A single cutter-head, designed to use mechanically clamped tools, makes possible eight cutting-edge changes without requiring a resetting of the cutters. The turner is made in several sizes to handle work from a minimum of 3/8 inch up to 6 inches in diameter.

Circle 621 on Readers' Service Card

REAMERS OF SOLID CARBIDE "MICRO" series in sixteen sizes introduced by the Atrax Co., Newington, Conn. These miniature tools are available in Series 9164, in eight fractional

sizes from 1/64 through 1/8 inch in diameter, and in Series 9158, decimal sizes ranging from 0.0151 through 0.115 inch in diameter. They are precision-ground tools with reamer-diameter tolerances of +0.0001 to +0.0003 inch. All reamers have four straight flutes with precision-ground lands to guarantee uniform, precise hole tolerance and long reamer life. Recommended for all materials, including steels up to Rockwell C 56 hardness.

Circle 622 on Readers' Service Card

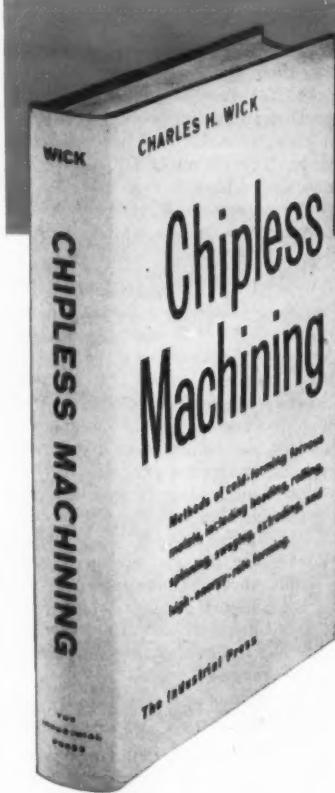
TAP CHUCK with compensating driver designed to assure positive drive and collet accuracy brought out by Erickson Tool Co., Solon, Ohio. This Model '09 tap chuck employs the Erickson double-angle design which assures concentricity to within 0.0005 inch true indicator reading. It is made in three sizes: E09, for taps from 0 to 1/4 inch; F09, with range of 0 to 7/8 inch; and G09, which has a range of 1/2 to 1 1/2 inches. Available with shanks for any spindles and recommended for precision lead-screw tapping. A bushing type collet is also available with the same compensating driver.

Circle 623 on Readers' Service Card

AUTOMATIC WELDING AND CUTTING TORCH announced by the Harris Calorific Co., Cleveland, Ohio. This new 18-2F automatic torch is said to offer users up to 50 per cent reductions in gas and oxygen consumption and increase production by eliminating frequent flame adjustments. A serrated thumb control, when turned to the "off" position, reduces the flame to a pilot light. Flicking the control to "on" restores the original preset flame. High-temperature silicone O-ring seals facilitate fast, easy change of tip assemblies. The torch's universal type mixer accommodates the first twelve Harris tip sizes. Welding-tip assemblies 15, 19, and 22 have individual mixers for maximum operating safety. The manufacturer's H-43-4 Multi-Flame (rosebud) heating assembly also may be used, as well as the Model 73 cutting attachment that cuts thicknesses up to 6 inches.

Circle 624 on Readers' Service Card

BUFFING MACHINE of automatic reciprocating straight-line type, incorporating oscillating fixture for finishing flat parts, available from Acme Mfg. Co., Detroit, Mich. This machine is especially designed for buffing and satin-finishing surfaces of flat-shaped parts such as stainless-steel stove, table, and sink tops; brass nameplates; kick plates; and grille work. It consists of an oscillating work-holding fixture mounted on a reciprocating platen. The platen speed



COLD-HEADING . . . THREAD-ROLLING . . . SPLINE ROLLING
POWER SPINNING . . . ROTARY SWAGING . . . RADIAL FORGING
COLD FORMING . . . COLD EXTRUSION . . . EXPLOSIVE FORMING

COVERS ALL THESE NEW PROCESSES

A new how-to volume on the subject of Chipless Machining—shaping metal parts without the production of chips. This technical book deals with the cold forming of steel by such processes as extrusion, radial forging, spline rolling, power spinning, and explosive forming.

This basic, practical guide is an important addition to your technical library because it brings together hitherto unavailable and widespread information about these newer processes in one convenient, useful text. It describes and illustrates in detail:

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- specific product design data and methods information of each process
- the range of various processes, their advantages and limitations—and their typical applications

The emphasis is on practice—theory is at a minimum. An extensive bibliography is provided for each process.

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326 Illustrations

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PURCHASING EXECUTIVES—Cost saving opportunities described and illustrated.

This book can also be used as a reference source in any metal processing or production planning course.

CONTENTS Chipless Machining. What it is and What it is not—Metallurgical Consideration of Plastic Deformation—Cold-Heading—Thread-Rolling—Rolling of Serrations, Splines & Gears—Power Spinning—Rotary Swaging, Radial Forging and Cold Forming of Multiple-Diameter Shafts—Cold Extrusion of Steel—Selecting of Materials and Designing Parts for Cold Extrusion—Applications of Cold Extrusion—Production of Slugs and Secondary Operations—Phosphate Coating and Lubricating for Cold Extrusion—Die Design for Cold Extrusion of Steel—Press Selection for Cold Extrusion—Explosives and Other High-Energy-Rate Forming Methods.

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Richard A. Ester, Vice-President

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can be varied with a 2-to-1 variable-speed drive having a normal range of 5 to 15 fpm. The length of the machine is dependent on the type and size of part to be finished.

Circle 625 on Readers' Service Card

TUMBLING MACHINE of small size announced by the Grav-i-Flo Corporation, Sturgis, Mich. This versatile PD-10 compact tumbling machine can be used for cob-meal or sawdust drying of metal parts, as well as deburring and burnishing, or cleaning operations. It weighs about 160 pounds, has a cylinder capacity of 6 cubic feet, and is furnished with either 1/3- or 1/2-hp motor drive. A simple lockpin mechanism provides for three tilting positions—load, unload, and running. The bin is 14 1/2 inches high by 38 inches wide by 41 inches long, weighs about 60 pounds, and uses a variety of mesh size screens.

Circle 626 on Readers' Service Card

PINCH POINTER developed by the Behr Machinery & Equipment Corporation, Rockford, Ill. This "Hi-Speed 400" pinch pointer has a capacity of 400 pieces per minute. It differs from other pinch pointers in that it will point screw blanks of any material or any other product requiring needle or diamond type points from No. 2 size up to a 5/16-inch (0.281-inch) diameter screw. Pieces of any length from 9/32 to 2 1/2 inches can be pointed. The four-speed rotary hopper has a V-belt drive powered with a 3/4-hp motor to handle heavy loads. A 5-hp motor drives the pinch mechanism. The entire unit measures only 30 by 66 inches and stands 66 inches high.

Circle 627 on Readers' Service Card

ISOSTATIC PRESSING SYSTEMS FOR POWDERED-METAL FORMING brought out by Autoclave Engineers, Inc., Erie, Pa. This system is designed to attain high density, uniform compaction of irregularly shaped powdered-metal or ceramic parts by means of hydraulic pressure. The complete package units for this system include: pumping equipment, compression cylinder, pressure vessel, valving, and instrumentation. The systems can be designed either for manual or automatic operation. Capacities range from small research-size units to large production systems.

Circle 628 on Readers' Service Card

GRIZZLY MACHINE CABINET STANDS for lathes and other production machines announced by Pucel Enterprises, Inc., Cleveland, Ohio. These rugged, all-welded-steel cabinet stands are designed for mounting lathes, grind-

ers, drill presses, and tapping and other production machines. They are also adapted for work-bench uses, and for manual training in schools, colleges, and universities. Models are available with tray coolant top and 1/2-inch pipe connection, and with drop front, especially for assembly and production work.

Circle 629 on Readers' Service Card

HYDRAULIC CYLINDER with spring-locked packing that eliminates fluid leakage brought out by Ward Hydraulics Inc., a subsidiary of Scott Aviation Corporation, Alden, N. Y. This heavy-duty hydraulic cylinder (700 series), incorporating a spring-lock action which automatically maintains constant preload between packing and rod, prevents fluid leakage resulting from worn packing. The cylinder is equipped with self-contained wiper, aircraft type self-locking retainer nut, all-steel piston and stuffing box components, and phenolic bearing and adapters which prevent metal contact with cylinder wall.

Circle 630 on Readers' Service Card

HIGH-STRENGTH BOLTS developed for high-fatigue 180,000-psi tension to meet a brand new military specification (MIL-B-8831) for aircraft, missile, and related applications announced by Standard Pressed Steel Co., Jenkintown, Pa. This new twelve-point external wrenching bolt, designated military part number MS 21250, is an upgraded, high-fatigue version of the SPS EWB 18, which has been covered by industry standard NAS 624. The principal change and main reason for the increased fatigue performance, is the use of the MIL-S-8879 thread form, which has a controlled, large-radius thread root. Fatigue strength is rated at 45,000 cycles minimum, 65,000 cycles average, at an alternating load of 93,000 psi maximum, based on the minimum minor thread area. Shear strength is 108,000 psi minimum. The twelve-point external wrenching bolt with mating lightweight (42FLW and 42FW series) lock-nut is available in diameter sizes of 1/4 through 1 1/2 inches.

Circle 631 on Readers' Service Card

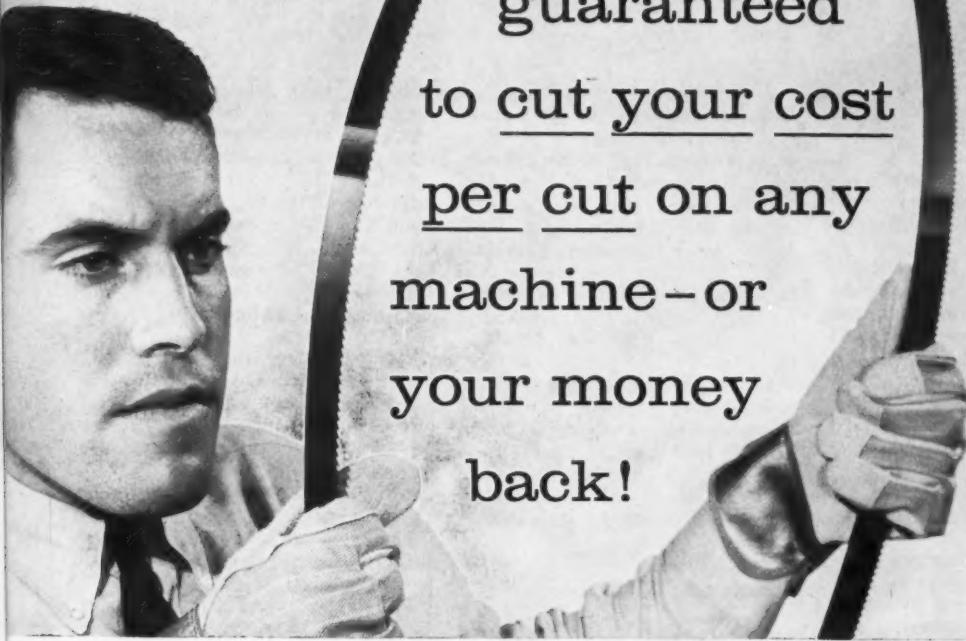
AUTOMATIC VACUUM FEEDER AND DESTACKER specially constructed to lift, transfer, and stack corrugated material up to 20 feet long in less than ten seconds announced by the Vac-U-Lift Co., Salem, Ill. This equipment can also be adapted to handle flat stock. The transfer unit, featuring chain-sprocket and ball-bearing carriage, is completely self-contained and is powered by a compact air motor and reducer for cushioned starts and stops.

Circle 632 on Readers' Service Card
(This section continued on page 238)



a
DoALL
PRODUCTIVITY-
PLUS
product

new
Dart® Blade
guaranteed
to cut your cost
per cut on any
machine—or
your money
back!



Try it for results like these!

NOW AVAILABLE in widths, pitches, and types for every job.

Dart® Precision

3/16, 1/4, 3/8, 1/2, 5/8, 3/4, and 1-in. blade in 6, 8, 10, 12, 14, 18, 24 and 32-pitch, depending on width; raker or wave set.

Dart® Buttress

3/16, 1/4, 3/8, 1/2, 3/4, and 1-in. blades in 3, 4, and 6-pitch, depending on width.

Dart® Claw Tooth

1/4, 3/8, 1/2, 3/4, and 1-in. blade in 3, 4, and 6-pitch, depending on width.

"... cannot afford to be without Dart blade. Initial increased investment of 10% is returned fourfold"—Zuelzke Tool & Engineering, Milwaukee.

"200% increase in blade life; rate of cutting increased 10%; accuracy greatly improved"—The Eldred Company, Columbus, Ohio.

"Dart blade on our horizontal saw has been running over a month and still like new; never before able to use any carbon blade for two weeks... getting straighter cuts; longer life; no messy coolant splash with lubricator you installed"—Embassy Metal Corporation, New York City.

"Your claim of 50 to 75% greater blade life is conservative. Cutting 2½" pipe, Dart outlasts two regular blades"—Minneapolis Ornamental Iron Company, Minneapolis.

"Blade life one and a half and two times previous. Straighter cuts eliminate scrap loss and secondary operation"—Vickery Engineering Company, Indianapolis.

Dart cuts cost per cut on any vertical or horizontal machine. Call your local DoALL store today for a demonstration.

THE DoALL COMPANY, Des Plaines, Illinois
Serving you locally through your DoALL Sales-Service Store

Special introductory offer: a free lubricator for your horizontal cutoff saws with an order of 12 Dart blades and one gal. #150 cutting oil.

DoALL ... the Productivity People

CALL YOUR
DoALL
SALES-SERVICE
STORE



MACHINE
TOOLS

Price \$10,330 Rent \$86.21
Model 2613-3 per week
Contour-matic* 23 types

BAND MACHINES

Price \$1475 Rent \$8.48
Model DH-612 per week
6" x 12" 12 types

SURFACE GRINDERS

Price \$2761 Rent \$17.70
Model C-12 per week
6 types

POWER SAWS

CUTTING TOOLS

DoALL SAW BANDS 18 types
All sizes

MEASURING INSTRUMENTS

SHOP BLOCKS* 84 pcs.

DoALL GAGE BLADES Price \$265
All sizes

GRANITE PLATES 18" x 24" All sizes, grades
Price \$80

SHOP SUPPLIES

BOTTLED FLUIDS For Every Purpose
All sizes

ROLL DOLLY 2,000 Sizes + grades
Price \$150

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DoALL STORE
In The
"Yellow Pages"

NEWS

of the Industry

Isabel Shamlian

California

HUGHES AIRCRAFT Co., Culver City, Calif., has announced that its Industrial Systems Division has opened district sales offices in New York and Chicago, Ill., and has appointed regional sales engineers in those cities and in Los Angeles. CHARLES S. JOHNSON will represent the division in the New York and New England areas, with offices at 600 Old Country Road, Garden City, N. Y. ROBERT H. COWAN has been named Chicago area sales engineer. He has established an office at 6120 W. North Ave. FRED VAN LAW is sales engineer for the southern California area, with offices at 5261 W. Imperial Highway, Los Angeles.

JOSEPH L. BURG, former vice-president of sales and engineering, has been elected president of BURGMAS-TER CORPORATION, Gardena, Calif.



Joseph L. Burg, new president of Burgmaster Corporation

Mr. Burg has been with the corporation since it was founded in 1945. He participated in all the major developments of the Tool Flex toolholders and the Burgmaster tur-drilling machines.

U. S. INDUSTRIES, INC., New York City, has announced the appointment of CHARLES E. LAMAR as president of its Southern Pipe Division, Azusa, Calif. He succeeds D. A. STROMSOE, who has retired after being with the division since its founding in 1932. Mr. Lamar, with Southern Pipe since 1951, has been successively sales manager, vice-president of marketing, and executive vice-president of the division.

LAWRENCE J. STEIN has been appointed sales engineer in the San Fernando Valley and central California area by AMERICAN DRILL BUSHING Co., Los Angeles, Calif. Mr. Stein has been with American for three years prior to this appointment.

Illinois and Indiana

DoALL Co., Des Plaines, Ill., has announced the following: DONALD W. MUELLER has been promoted to cutting-tool product manager of the company. He succeeds ROBERT PETCH, who has become director of purchasing. JOSEPH BENEDICT has been named product sales manager on O. E. M. products, special machines, and fixturing. LLOYD L. SHANKS has joined the sales department, serving as coordinator in all phases of sales management, personnel, market research, promotion, and field work conducted through DoALL's nationwide network of forty sales-service stores.

UDDEHOLM CO. OF AMERICA, New York City, has announced the opening of a modern specialty steel service center at 1400 Nicholas Blvd., Elk Grove Village, Ill. The new installation, part of the Centex Industrial Park, will have in stock a complete line of Uddeholm specialty spring and strip steels, tool and die steels, and seamless steel boiler tubes. It will be managed by GUNNAR SVENSSON and will serve the entire Chicago-Milwaukee industrial area.

VERSON ALLSTEEL PRESS CO., Chi-

cago, Ill., has announced the appointment of J. NOVAK INDUSTRIES, INC., Chicago, as manufacturers' representative for its Contract Division in the northern Illinois, northwestern Indiana area. The Novak organization will provide service to buyers of fabrications, machining, speed reducers, gearing, die sets, bolsters and adapters, special machinery, and machinery rebuilding.

The opening of a Chicago, Ill., office for sales and service of Pacific hydraulic shears, press brakes, and dies has been announced by PACIFIC PRESS & SHEAR CORPORATION, Mount Carmel, Ill., Located at 110 N. Spring St., La Grange, Ill., the office serves greater Chicago and northern Illinois and is headed by JIM McHUGH, regional sales manager.

The appointment of JOHN CONRAD as Chicago, Ill., district manager has been announced by ETTCO TOOL & MACHINE CO., INC., Brooklyn, N. Y. Mr. Conrad will make his headquarters in the firm's new and enlarged office located at 5711 W. Chicago Ave.

H. L. STEWART has been appointed vice-president and sales manager of LOGANSFORT MACHINE CO., INC., Logansport, Ind. For the past year and a half Mr. Stewart has been associated with SCOTT INDUSTRIAL EQUIPMENT CO., Indianapolis. Prior to that time, he spent over seventeen years with his present employer in sales, advertising, and engineering.

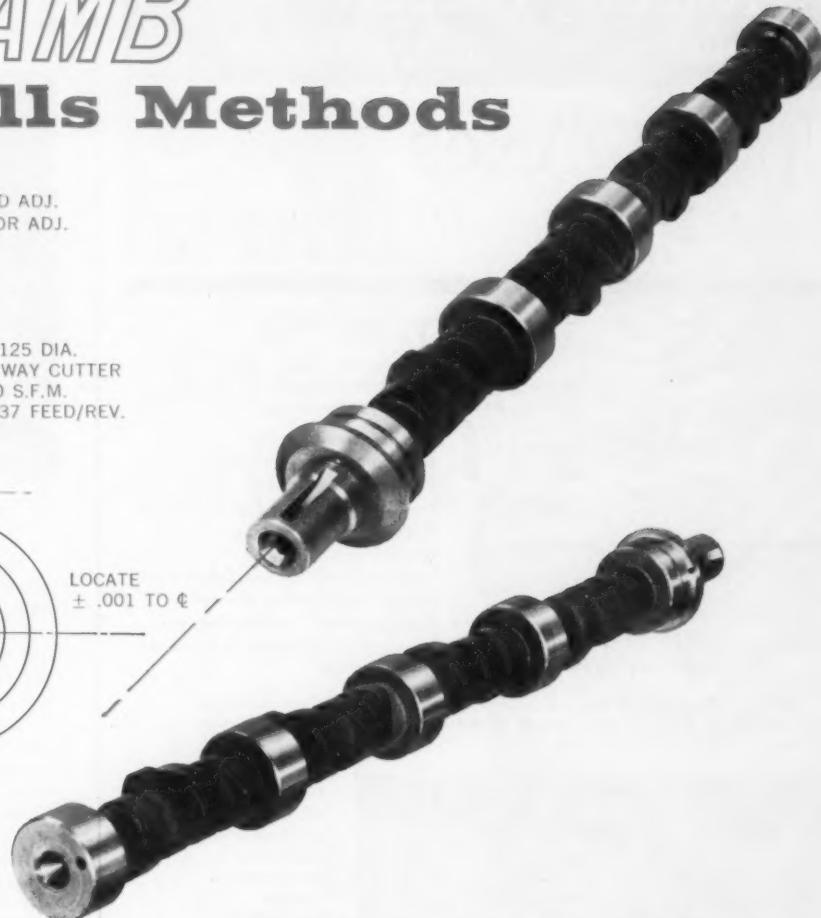
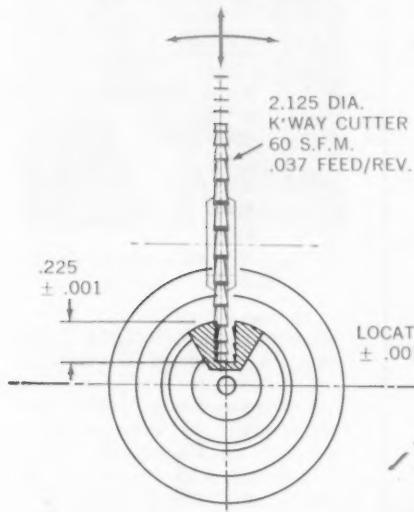
Minnesota, Michigan, and Wisconsin

Franchisement of VINCENT BRASS & ALUMINUM Co., Minneapolis, Minn., as a distributor for Hannifin power cylinders and air-control valves, and Crown air-pressure regulators, filters, and lubricators, has been announced by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio. Technical assistance to the organiza-

LAMB

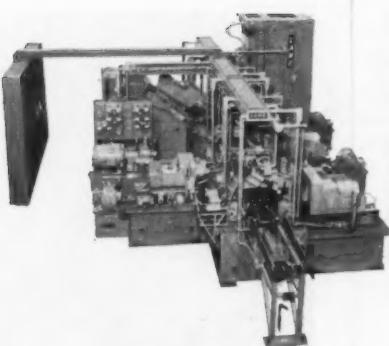
Sells Methods

VERTICAL MILL HEAD ADJ.
RADIAL PART LOCATOR ADJ.



C.I. camshafts for 6 and 8 cylinder engines
mill, drill, tap and probe 2 at-a-time.

Mill heads on this 7-station machine are adjustable for precise depth and centrality. Adjustable part locators provide desired radial position for milling the timing gear key slot—the qualifying operation for all subsequent machining. These adjustments will permit future changes in engine timing. Lamb special attention to manufacturing methods will be reflected as quality and economy in your workpiece.



9739

F. JOS LAMB CO.

5663 E. NINE MILE ROAD • DETROIT 34, MICHIGAN

Since 1914 Engineers and Builders of Special Machines and Automation Equipment
MACHINERY, December, 1961

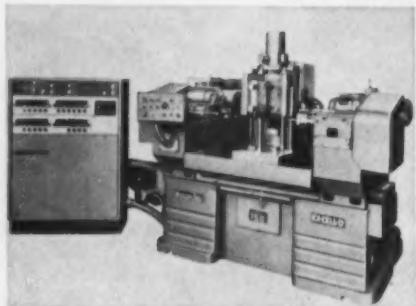
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221

Rheem Electronics

NUMERICAL POSITIONING CONTROLS

Up to 6 Axes Competitively Priced!



Rheem Numerical Control with Excello Model 75B
Numera-trol boring machine.

- Reduce lead time ■ Improve product quality ■ Eliminate expensive jigs and fixtures ■ Reduce scrap loss ■ Make small lots economical ■ Minimize inventory and re-run problems

VERSATILE

One system fits many machines . . . offers savings in operator training, planning, maintenance.

- Modular construction by axis
- Different resolutions available
- High positioning speed
- Feed rate control available
- Large travel distances
- No stepping switches used
- Tape information distributed electronically
- Decimal display of tape information
- Virtually unlimited auxiliary functions
- Automatic, semi-automatic, and manual operation modes

tion is provided by GEORGE C. STEPHENS, Parker-Hannifin representative in the Wisconsin-Minnesota area.



William M. James, vice-president
—sales, Scherr-Tumico, Inc.

SCHERR-TUMICO, INC., St. James, Minn., has promoted WILLIAM M. JAMES to vice-president in charge of sales. Mr. James was formerly general manager of SCHERR-TUMICO NEW YORK CO. He succeeds ROBERT V. ANDERSON, who was recently appointed managing director of SCHERR-TUMICO ISRAEL, a new manufacturing company expected to contribute substantially to sales of the firm's products in international markets starting next year.

E. W. BLISS CO., Canton, Ohio, has named N. LAURENCE DESMOND factory manager of the Hastings (Mich.) Division. In his new position, Mr. Desmond will be responsible for all manufacturing operations.



Rheem
Numerical Control
with Burgmaster
25AHT turret
drilling machine.
Complete
2 or 3-axis
systems available.

Write
for full
information
TODAY!



RHEEM POSITION DISPLAY

Designed to meet the requirements of operator controlled machines including retrofit on existing machines and inspection machines. Allows operator to position machine more rapidly and with greater accuracy, reduce operator fatigue, and avoid errors associated with reading of dials. For partial automation in both small and large shops. Available for one, two, or more axes of motion with typical resolutions of 0.001 or 0.0001 inches.



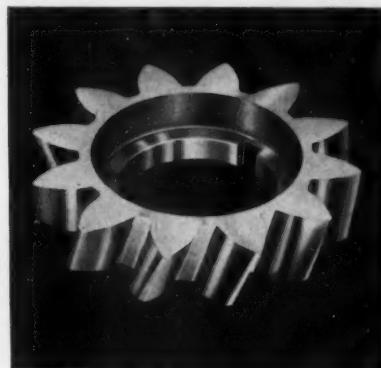
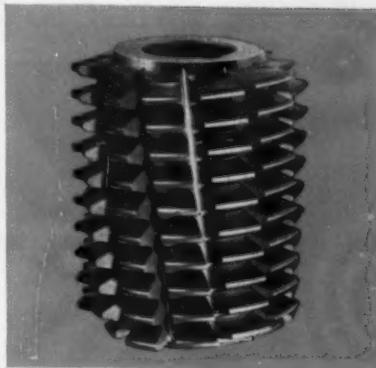
A division of Rheem Manufacturing Company

5200 West 104th Street
Los Angeles 45, California
SPring 6-1800



N. Laurence Desmond, newly
named Hastings Division factory
manager, E. W. Bliss Co.

the more gears
you cut,
the greater
your need
for job-tailored
Illinite®
hobs and
shaper
cutters!



Increased costs and capacities of modern mass-production machines impose performance responsibilities which all-purpose tools were never intended to meet. That's why more and more volume gear-makers are protecting their capital investments with *job-tailored* Illinite hobs and shaper cutters.

Whether mass-produced gears are standards or specials, you'll get better work at lower costs with designed-for-you Illinite gear cutting tools—the specific-purpose hobs and shaper cutters that turn out

consistent, economical accuracy. *They're developed and made to do one job best—and this means long life, top output, low rejects.*

For nearly 50 years, Illinois Tool Works has helped gear makers solve troublesome problems through improved gear geometry, superior metallurgy, and precise inspections for accuracy. Experienced ITW field engineers will be glad to study your production facilities as well as end-use requirements, and submit cost-cutting recommendations.



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& INSTRUMENT**

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Write for these two informative handbooks, "Faster Gear Production" and "Know Your Shaper Cutters"—two "musts" for your technical library. Do it now before you forget.

BOSTON *Gear*® QUALITY

14½° stock gears 20°



Largest selection - off the shelf.

1781 types and sizes 14½° P.A. - 48 to 3 pitch.

782 types and sizes 20° P.A. - 120 to 4 pitch.

Spur, bevel, miter, worm, helical, spiral miter.

Brass, steel, iron, nonmetallic. See Catalog 57.

IN STOCK at your nearby DISTRIBUTOR

BOSTON *Gear*®

© Boston Gear Works, 1961
Quincy 71, Mass.



Howard A. Sage, manager—can machinery plant, Hastings Division of E. W. Bliss Co.

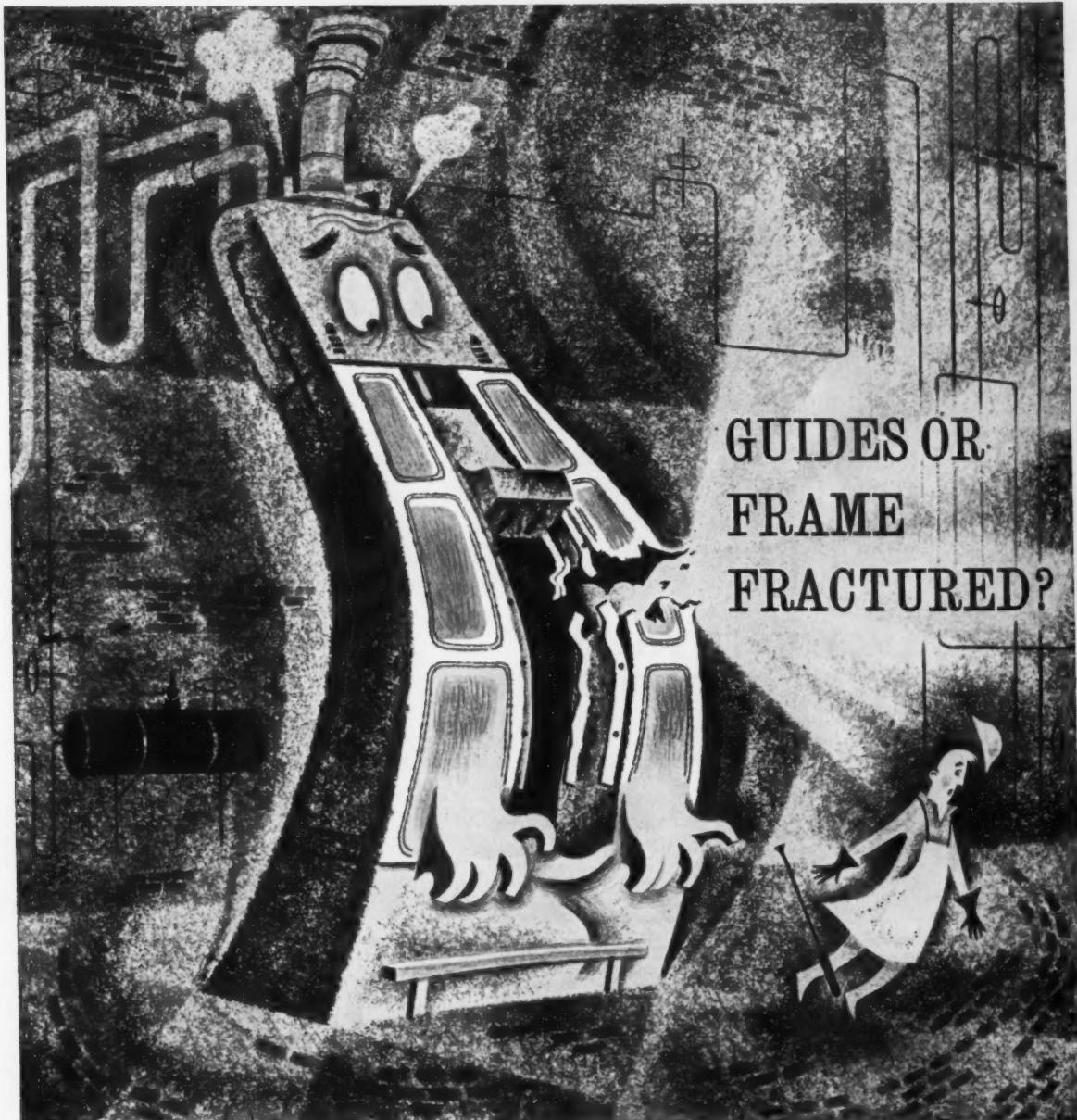
including machine-shop, foundry, and assembly departments. HOWARD A. SAGE has been appointed manager of the can machinery plant. In this capacity, he replaces B. E. MEYER, who was recently named general sales manager for the division. JAMES L. CHASE has been made sales manager of container machinery at Hastings.



Richard W. Hallock, new manager of the Enterprise Division of Michigan Tool Co.

The appointment of RICHARD W. HALLOCK as manager of the Enterprise Division has been announced by MICHIGAN TOOL CO., Detroit, Mich. Mr. Hallock, formerly assistant to the manager of the company's Manistee (Mich.) Iron Works Division, originally joined the firm in 1951.

WHEEL TRUEING TOOL CO., Detroit, Mich., has named DONALD J.



GUIDES OR
FRAME
FRACTURED?

Call ERIE FOUNDRY for forging hammer replacement parts

Replacement guides, frames, and other parts for a wide variety of forging hammers of most any make are available from ERIE. They are high in quality, competitive in price.

For over 65 years we have specialized in the design, development and manufacture of forging hammers of all types. Logically, then, Erie Foundry is a natural source for repair parts equal in quality and performance to the original equipment. Substantial inventories assure you of prompt service. For more information on repair parts or our complete Hammer Rebuilding Service, write Mr. James Walker.

Manufacturers of Forging Hammers • Forging Presses • Hydraulic Presses • Trimming Presses

MACHINERY, December, 1961

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ONE OF THE GREAT NAMES
IN FORGING SINCE 1895

ERIE FOUNDRY CO., Erie, Pa.

K-8126

225



ALVEY USES THESE VICKERS COMPONENTS



DOUBLE PUMPS—Vickers double pumps provide power for multiple circuits from a central source, feature long life, minimum maintenance, quiet operation. Various combinations are available for deliveries from 1.0 to 34 at the head end and 1.0 to 55.0 gpm at the shaft end, pressures to 2000 psi.



DIRECTIONAL VALVES—Both single- and double-solenoid directional valves are used on the pallet loaders. Vickers exclusive *QEL solenoids are featured. Complete line of valves and controls accommodates flows to 440 gpm, pressures to 3000 psi.

*Quiet, Extended Life.



BALANCED VANE MOTORS—Durable construction, high operating efficiency, long life and low maintenance costs are features of Vickers vane motors. Broad line of fluid motors includes fixed and variable models with horsepower ratings to 350 hp.

CHECK AND RELIEF VALVES—A complete line of valves—relief, sequence and unloading, sequence and check, pressure reducing, unloading and relief valves—is available to meet every system need.

For details about components above and the entire Vickers line, write for Catalog 5001C. Vickers Incorporated, Division of Sperry Rand Corporation, Detroit 32, Michigan.

WALLACE vice-president—sales for the Detroit Tool Sales Division. Mr. Wallace joined the company as a trainee in 1933, and has risen through production and administrative posts. Assisting him will be ARTHUR J. BAEBER, promoted to sales manager of the division. JAMES E. SLANAKER succeeds Mr. Baehr as sales representative in Cleveland, Ohio. Mr. Slanaker's territory includes northern Ohio and western Pennsylvania.

Stockholders of MCINTOSH STAMPING CORPORATION, Detroit, Mich., have approved changing the name of the company to MCINTOSH, INC. Also announced was the construction of a new plant at Berne, Ind., to manufacture heavy-gage pressed and coined steel parts. The plant, with 8,000 square feet of floor area, represents an investment of approximately \$250,000, and will increase the company's productive capacity by supplementing its Detroit facilities and operations. It will be known as the BERNE DIVISION.

The appointment of JOHN C. SHOVLIN as sales engineer has been announced by SNYDER CORPORATION, Detroit, Mich. In his new capacity, Mr. Shovlin will work out of the corporation's Detroit sales office and handle sales in the Flint, Saginaw, and Lansing areas.

PHILLIPS L. WATERMAN has been appointed a special executive representative at the Detroit, Mich., headquarters of REVERE COPPER & BRASS INC., New York City. Mr. Waterman has been district manager of the company's Grand Rapids sales office since 1944.

KEARNEY & TRECKER CORPORATION, Milwaukee (West Allis), Wis., will vacate its main plant facilities at 6800 W. National Ave. during the next year in a consolidation program which will see the company move its entire operation under one roof at the present Highway 100 plant (555 S. 108th St.). About \$3,000,000 will be spent in making the change-over, most of which will go for approximately 220,000 square feet of new manufacturing space and material-handling facilities, and a new office wing providing 60,000 additional square feet to present accommodations.

New England

DAVID E. DUFFY has been made sales manager of JACOBS MFG. CO., West Hartford, Conn. Mr. Duffy as-



PETE HORN, VICE PRESIDENT—ENGINEERING, ALVEY CONVEYOR MFG. CO. SAYS:

"Hydraulics assure smooth, steady operation..."

... of the Alvey Automatic Pallet Loader. This equipment can, without stalling, palletize over 60 cases of products per minute, depending on case size. One Alvey Pallet Loader can be equipped to accommodate a wide variety of package sizes. Its electrically controlled hydraulic circuit assures smooth operation at fast speeds, thus helps prevent damage to fragile cartons and their expensive contents.

The equipment must also be dependable and easy to service. We were able to meet these specifications, by working closely with Vickers engineers to select components matched precisely to our operating requirements.

There are real advantages both for us at Alvey and for our customers because Vickers maintains an extensive field service organization and regional stocks of spare parts."

Are you aware of the "added benefits" available only to users of Vickers hydraulic equipment . . . single line application engineering . . . unmatched field service . . . regional repair and parts stocking . . . training for your personnel . . . worldwide interchangeability of parts?

Get the complete story from your Vickers application engineer, Vickers Incorporated, Division of Sperry Rand Corporation, Detroit 32, Michigan.

VICKERS®
DIVISION OF SPERRY RAND CORPORATION



David E. Duffy, sales manager of Jacobs Mfg. Co.

sumes increased responsibilities in the sale of Jacobs drill chucks and collet chucks in both the domestic and export fields.

NEW BRITAIN MACHINE CO., New Britain, Conn., has announced two promotions on the sales staff of NEW BRITAIN-GRIDLEY MACHINE DIVISION. JAMES M. BEYVL and MAX C. HART-

MANN have been made sales engineers. Mr. Beyvl's sales territory will include eastern Pennsylvania, southern New Jersey, Delaware, and a portion of Maryland. Mr. Hartmann's sales territory will include western Connecticut, metropolitan New York, southern sections of New York, and northern New Jersey.

PRATT & WHITNEY AIRCRAFT, division of UNITED AIRCRAFT CORPORATION, East Hartford, Conn., has named RICHARD T. BASELER assistant engineering manager of the division. Two other senior engineers have been promoted to key positions. WALTER DOLL has been made chief engineer for advanced power systems; and DONALD J. JORDAN, chief engineer for advanced jet power plants.

REVERE COPPER & BRASS, INC., New York City, has made NORMAN F. KELLEY sales manager of the New Bedford (Mass.) Division. Mr. Kelley has been assistant sales manager for the division since June of this year, and succeeds CHARLES G. MILLER, who is retiring.

LEON M. CLEVELAND has been

made sales and service representative in the New England territory for CONE AUTOMATIC MACHINE CO., INC., Windsor, Vt. Mr. Cleveland was formerly service manager.



Henry A. Szostek, sales manager, Cutting Tool Division, Brown & Sharpe Mfg. Co.

BROWN & SHARPE MFG. CO., Providence, R. I., has appointed HENRY A. SZOSTEK sales manager of the Cutting Tool Division. Mr. Szostek was formerly in charge of the combined north-central and eastern sales districts.

New York and New Jersey

AIRCO CO. INTERNATIONAL, a division of AIR REDUCTION CO., INC., New York City, has appointed A. M. ANDREWS, JR., president, succeeding J. G. BELL, who is retiring. As president, Mr. Andrews will be responsible for the sale and distribution of Air Reduction products in more than sixty-five foreign countries.



A. M. Andrews, Jr., president of Airco Co. International

HOW TO DESIGN EXCESS WEAR Out of MACHINE TOOLS WITH MADISON-KIPP Fresh Oil Lubricators

Machine Tools, Compressors and special machines of all kinds have been kept in top condition for 20 or 30 years or more when equipped with one of 6 models of Madison-Kipp Lubricators.

Fresh Oil Lubrication is automatic, closely measured, constantly fed new oil under pressure for each friction surface to which it is applied.



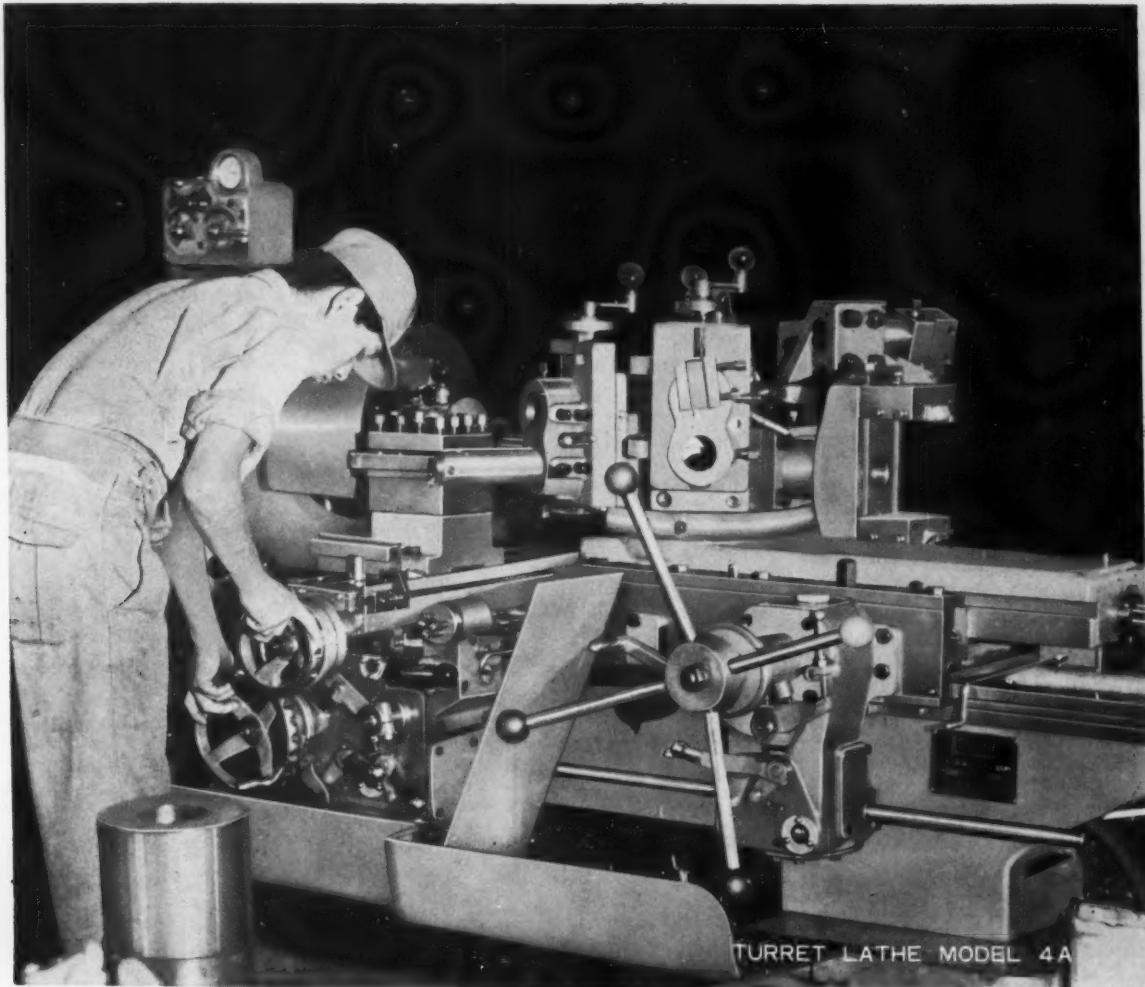
The Model OL—one of the 6 Models of Madison-Kipp Lubricators.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WISCONSIN

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

High Productivity with Precision and Economy... Use Sturdy HITACHI SEIKI Machine Tools



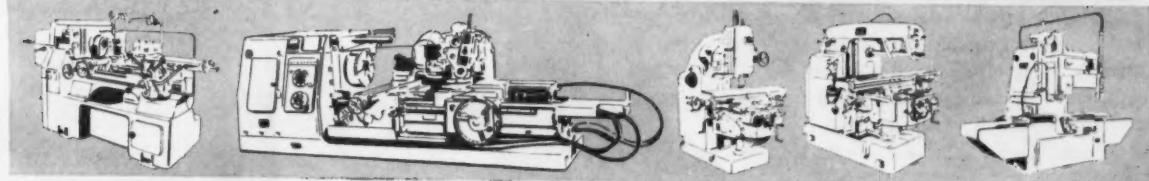
TURRET LATHE MODEL 4A

Best Prices and Fastest Delivery from Japan.

HITACHI SEIKI machine tools are designed and manufactured to meet the present day demands for high precision super-speed machining. Durability combined with high volume production assures low maintenance cost, conducive to profitable operations.

Machines include Turret Lathes, Milling Machines, etc.

HITACHI SEIKI MACHINE TOOLS



SEIKI

Sole Export Agent: **HAKKO CO., LTD.**

2, 2-chome, Marunouchi, Chiyoda-ku, Tokyo, Japan

For detailed information, please contact HAKKO CO., LTD. Representative Office of Los Angeles: 4832 West Pico Blvd., Los Angeles
Kanematsu New York Inc.: 150 Broadway, New York 38, N.Y.

SENECA FALLS MACHINE CO., Seneca Falls, N. Y., has appointed RUSSELL M. WHEELER manager of production and quality control. As the title implies, Mr. Wheeler, who has been with the company since 1941, will direct an intensified program of product betterment. ARTHUR S. DINSMORE, formerly assistant, has been named chief engineer of the company. Mr. Dinsmore has been with Seneca Falls since 1947.

OAKITE PRODUCTS, INC., New York City, has appointed RICHARD F. LATT and DONALD F. MOULTON members of the company's field service organization. Mr. Latt will serve the metal industries in the south Buffalo, N. Y., area. Mr. Moulton has been assigned to the state of Vermont.

The appointment of HARRY J. HART as export manager has been announced by GLEASON WORKS, Rochester, N. Y. Mr. Hart will be responsible for managing export sales activities of the firm and for its relations with world-wide dealer organizations.

EDMOND MALONE has joined CIRCO CORPORATION, Clark, N. J.—



Edmond Malone, new manager of the Chemical Products Division of Circo Corporation

subsidiary of BRANSON INSTRUMENTS—as manager of the new Chemical Products Division. Mr. Malone comes to Circo with a wealth of experience, having spent eight years with another leading manufacturer of cleaning chemicals.

INDUCTOTHERM CORPORATION has moved to a new 35,000-square-foot

plant at 10 Indel Ave., Rancocas, N. J. The new plant also houses the firm's subsidiary, INDUCTOTHERM LINEMELT CORPORATION.

Ohio

WARNER & SWASEY CO., Cleveland, Ohio, has purchased for cash the assets of LAHR MACHINE & TOOL CORPORATION, Toledo. Lahr, which designs and manufactures special-purpose deep-hole and gun-drilling machines, will be known as LAHR MACHINE DIVISION OF WARNER & SWASEY CO. It will continue to operate in Toledo under its existing management. EDWARD F. LAUMANN, who has been president of Lahr, will be general manager of the new division, and JOHN HOENIG will continue to be responsible for manufacturing and engineering.

WILLIAM R. MATTHIESSEN has been promoted to president and district sales manager of DoALL TOLEDO Co., Toledo, Ohio. He will be available to help the manufacturers in northwestern Ohio and southeastern Michigan improve their cutting and finishing techniques on all kinds of materials.

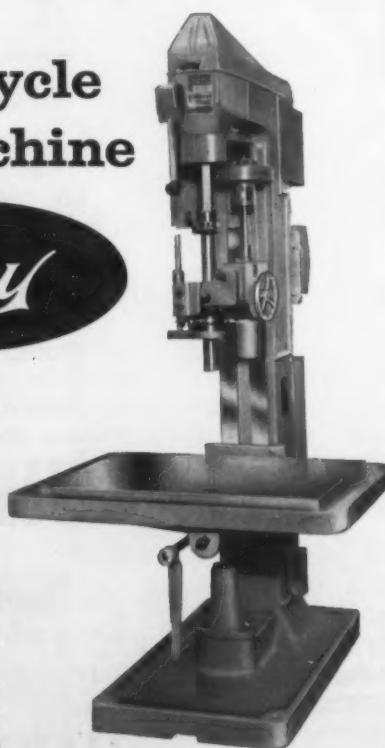
PRESSED METAL INSTITUTE, Cleveland, Ohio—the national association of metal stampers and their suppliers of material equipment—has changed its name to AMERICAN METAL STAMPING ASSOCIATION.

E. W. BLISS CO., Canton, Ohio, has announced the consolidation of Salem and Canton operations into a single Heavy Equipment Division. GEORGE PERRAULT, Jr., presently vice-president and manager of the Salem Division, will manage the new

automatic cycle drilling machine



You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit. Adjustable rapid power traverse, feed, and rapid return of the spindle permit automatic transfer or rotary index fixturing. You also get adjustable feeds, speeds, table travel, head travel, and Avey's precision spindle. Morse Taper 2, 3, or 4; single or multiple spindles 1 to 5 hp. Write or phone for data. Avey, Box 1264, Cincinnati 1, Ohio.



George Perrault, Jr., manager of the Heavy Equipment Division of E. W. Bliss Co.

At Homestead District Works, U. S. Steel—



MICROHONING CUTS BORE FINISHING TIME FROM 60 HOURS TO 4 HOURS



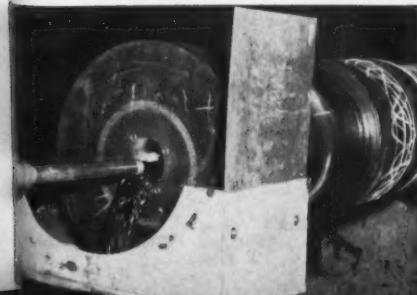
Getting it from both ends, the shaft bore receives a copious supply of coolant. A large capacity coolant filter unit, and a special trough system, keep the coolant circulating to provide a means of flushing the swarf from the work area, and contributing to a more effective cutting action of the abrasives.

The bore of a typical large steel shaft forging is now finished in four hours by Microhoning . . . an operation which previously took sixty hours of dry lapping! The forgings—for ship shafts, turbines, and cyclotron electrodes—range from 2' to 5' in diameter and as long as 45' (114 tons).

Designed to operate at high speeds, it is essential that the bores be accurate, straight, concentric with the O.D. and with a specified microfinish. After the bore is finished, the ends are plugged with centers to machine the O.D.

In typical performance Microhoning removes approximately .025" stock from a 4.5" bore 27' long in one hour and with a surface finish of 10-20 rms. Bores previously were lapped for 60 hours and more.

Micromatic Hone provides all the machining elements . . . machine, tooling, abrasives, coolant. This integrated approach is a significant factor in the achievement of these spectacular savings for U. S. Steel. You, too, can benefit from the one-source approach to honing operations . . . a call or letter will bring a field engineer to point up the specifics for your application. Why not do it today.



**MICROMATIC HONE
CORPORATION**

SCHOOLCRAFT AT GREENLAWN • DETROIT 38, MICHIGAN



division and his headquarters will be in Salem. Corporate headquarters for E. W. Bliss Co. will continue to be located in Canton.

NEW BRITAIN MACHINE CO., New Britain, Conn., has announced that it will manufacture vertical profiling and milling machines previously built by MOREY MACHINERY CO., INC., New York City. A complete line of profilers will be built in the Cleveland, Ohio, plant of New Britain Machine Co.'s LUCAS MACHINE DIVISION. WILLIAM J. PETERS, former president of MOREY MACHINE TOOL

Co., Inc., is in charge of profiler operations, and will make his headquarters at the division in Cleveland.

Tennessee and Kentucky

LOUIE L. ETHERIDGE has been appointed vice-president and general manager of DoALL TENNESSEE Co., Nashville, Tenn. The company serves manufacturers in Tennessee and the western half of Kentucky with machine tools, cutting tools, and precision gaging equipment.

The announcement of AIR-HYDRO POWER CO., Louisville, Ky., as a distributor for Hannifin power cylinders and air-control valves, Crown compressed-air preparation units, and Parker industrial tube and hose fittings and hydraulic valves has been made by PARKER-HANNIFIN CORPORATION, Cleveland, Ohio. Technical assistance for the firm is provided by R. A. BECKERT, Parker-Hannifin representative in the Cincinnati-Louisville district.

Texas

WILLIAM J. KOTOWICZ has been named manager of aluminum sales at the Houston, Tex., plant of JOSEPH T. RYERSON & SON, INC., Chicago, Ill. Previously, he had been a field representative responsible for the sale of the company's full line of steel, aluminum, industrial plastics, and metal-fabricating machinery.

DONALD M. PRICHARD has been appointed southwest sales engineer for the Industrial Controls Section of BENDIX CORPORATION, Detroit, Mich. The southwest regional office is located in Dallas, Tex.

JEFF R. SUMMERS, JR., has been made a sales engineer for DoALL DALLAS CO., Dallas, Tex. He will act as a machine tool specialist, serving industrial accounts in Fort Worth and counties to the west.

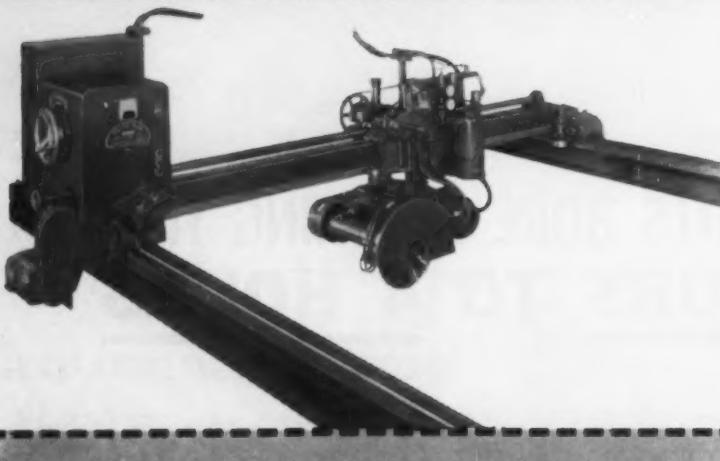
Canada

EDWARD (TED) LINDSAY, sales engineer for DoALL CO., OF CANADA, has been promoted to manager of the Vancouver sales-service store of the Canadian company. Mr. Lindsay will be responsible for sales and service in the provinces of British Columbia and Alberta.

Germany

BENDIX CORPORATION, Detroit, Mich., has announced acquisition of a one-third interest in NIEBERDING & CO., G.M.B.H., Neuss, Germany, a manufacturer of pneumatic gaging for industry. Licensing agreements also were concluded between the two firms whereby the German company will manufacture the complete line of precision air gages of SHEFFIELD CORPORATION, Dayton, Ohio, a Bendix subsidiary. Nieberding will handle sales of Sheffield's precision measurement instruments, automatic gaging and assembly machines, and machine tools in Germany, Austria, and Denmark.

ECONOMY SAW CUTS SHEET STOCK WITH 4-WAY ACTION



Accurate Squares up to 10 ft. Wide
Any Length — Cuts Metal or Plastics

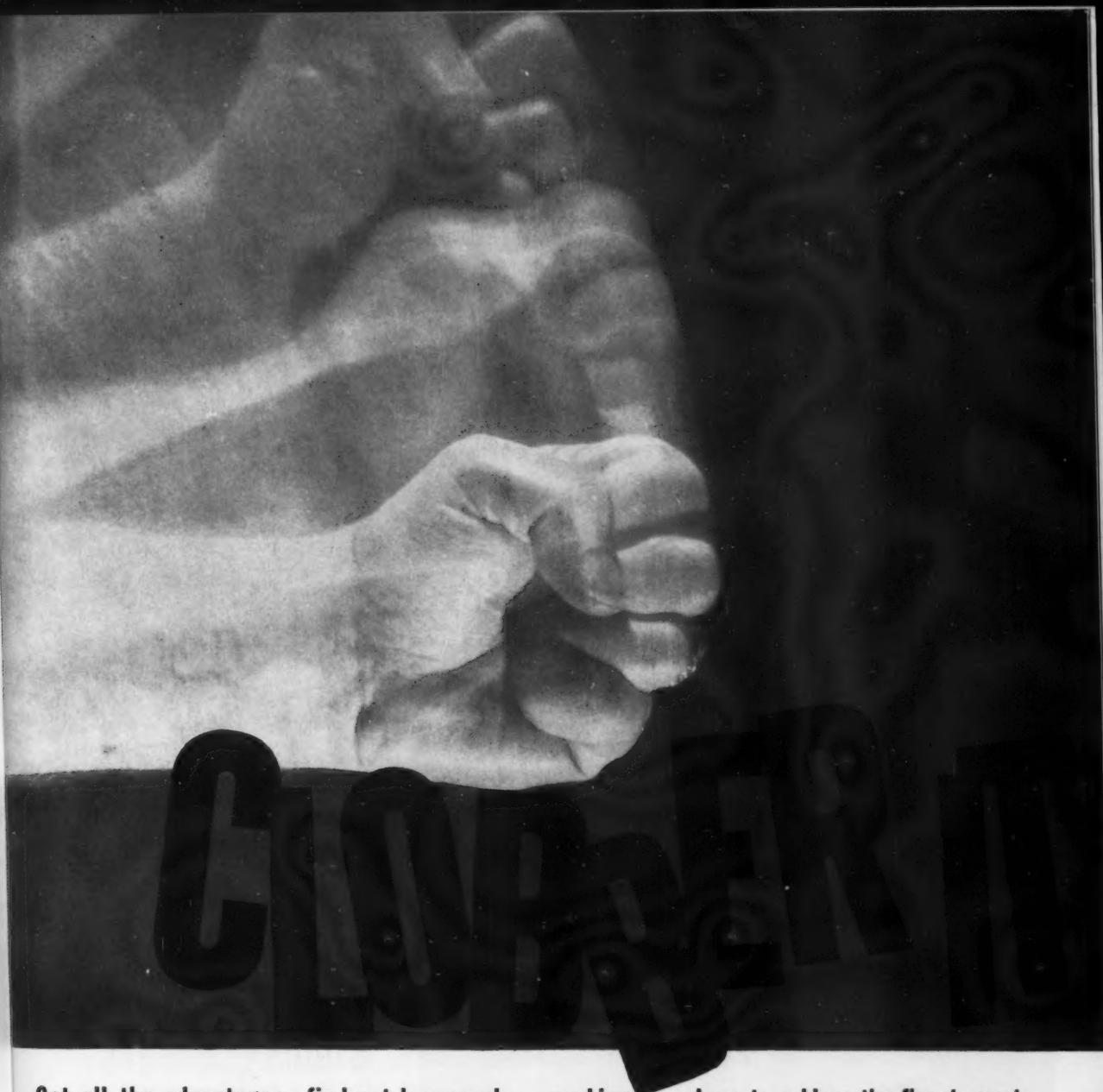
The new Ty-Sa-Man Economy "111-CX" produces accurate square rectangles up to any length, and up to 10 feet wide, from stock up to two inches thick. Motor and arbor travel on a transverse rail, which moves along two side rails. This four-way movement, in combination with the 90 degree swivel head, permits trimming all four sides of a plate without moving it. Handling time is reduced to a minimum.

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Ty-Sa-Man

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working shops to achieve the finest, most machinable steels in the world. Send today for your free copy of the booklet, "Properties of Ledloy Steels," and be sure you use Inland Ledloy leaded steels—you can count on them because they're backed up by more than 20 years of continuous research, development and practical experience. Ledloy steels are available from your Cold Drawer or your local Steel Service Center.

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the world's most machinable steels

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Obituaries

John S. Morton

JOHN S. MORTON, director of ENGS EQUIPMENT CO., Chicago, Ill., died suddenly on October 12. Mr. Morton was born and educated in Germany and resided in the United States for more than thirty years. The necessity of producing ultrafine finishes on precision gimbals bearings at the beginning of World War II led him

to the invention of diamond compounds which had to satisfy the most stringent requirements of stability, durability, and precise repetitive performance. His inventions have received recognition as major accomplishments for the better production of fine surfaces throughout the industry of the world.

N. E. Molleck

N. E. MOLLECK, general superintendent of production at MAYTAG

Co.'s Plant 1 in Newton, Iowa, for the past thirteen years, died on October 27. His age was sixty-three. Mr. Molleck had been with the firm for nearly forty-three years. He was a member of the Maytag Management Club and had served on the Maytag Labor-Management Council.



William A. Humel

WILLIAM A. HUMEL, vice-president and general manager of PARK DROP FORCE CO., Cleveland, Ohio, died on October 9 at the age of sixty-six. Mr. Humel had been associated with the heavy die forging and crankshaft concern since 1914, when he joined the company as a draftsman. He rose through the ranks and had been vice-president and general manager for a number of years. Mr. Humel also served as a director of the firm.

Coming Events

DECEMBER 1—Malleable Founders Society's Semiannual Meeting, to be held at the Hotel Sheraton-Cleveland, Cleveland, Ohio. For further data, contact the society at 781 Union Commerce Bldg., Cleveland 14, Ohio.

JANUARY 8-12—1962 SAE Automotive Engineering Congress and Exposition, to be held in Cobo Hall, Detroit, Mich. For more details, contact Robert W. Crory, Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

FEBRUARY 2-3—UCLA's Fourteenth Annual Industrial Engineering Institute, to be given on the Los Angeles campus. For further information, write to Department K, Uni-

An advertisement for L & J Press Corporation. It features a large industrial press machine on the left, with the company's logo and name on the right. The text reads: "EFFICIENT... ACCURATE... DEPENDABLE".

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150 TON
STRAIGHT SIDE
PRESS

STANDARD EQUIPMENT

ALL HIGH QUALITY

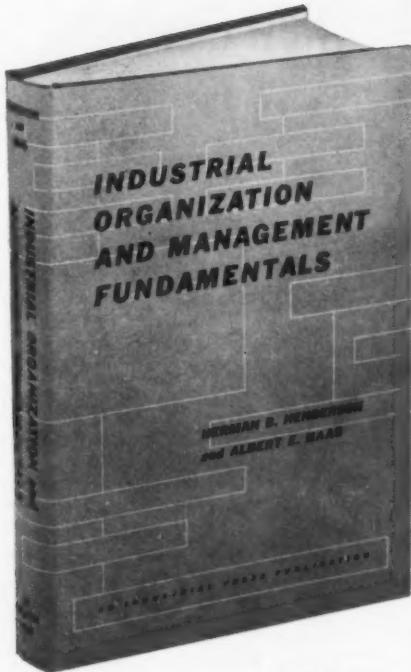
Including—Air clutch, I.I.C. wiring and controls. Shaft driven limit switch. Sole-noid-controlled dual air valve. Replaceable wear strips on slide. Hard bronze crankshaft bearings. Replaceable ball seats. Air counter balances on slide. One-shot forced lubrication. Gears run in oil. Optional equipment as required.



WRITE for complete information on 20- to 150-ton straight side presses, 14- to 150-ton O.B.I. presses and 30- to 75-ton gap frame presses.

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Informative chapters cover these areas of management

1. History and Challenge of Industry
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8. Finances—Planning Capital Requirements
9. Finances—Maintenance and Replacement Policies
10. Organization—The Tool of Management
11. Organizational Patterns and Their Design
12. Leadership and Industrial Relations
13. Wage and Salary Administration
14. Marketing the Product
15. The Economical Utilization of Labor's Time and Effort
16. Job Simplification Through Motion Study
17. Establishment and Application of Work Measurements
18. Production, Planning Control and Purchasing
19. Inventory Control and Purchasing
20. Quality Control
21. Cost Reduction and Cost Control

JUST PUBLISHED!

A Step-By-Step Guide To Industrial Organization And Management Fundamentals

by H. B. HENDERSON, Industrial Management Consultant and

A. E. HAAS, Professor and Chairmen, Department of Business Technology, State University Agricultural and Technical Institute, Farmingdale, New York

Do you want a clear understanding of industrial organization and its management problems?

Are you a management executive who's thinking of starting, or operating, an industrial enterprise?

Do you want to widen your knowledge beyond the scope of your present industrial occupation?

Here, at last, is a book on management fundamentals for the man aiming for advancement to the management team, or interested in starting or operating his own industrial enterprise. It is a clear, realistic approach to industrial organization and management fundamentals, which gives a concise insight into the various problems faced by management people. Although primarily designed for use in technical institutes and specialized colleges, this book can also be used for home study and in-plant training courses.

One of the outstanding qualities of this book is that it is free of much of the detail and subsidiary technical material which is present in third- or fourth-year college texts. It quickly gets into the "meat" of the subject, and in a clear, readable style presents the basic fundamentals with numerous easy-to-follow charts and diagrams. These diagrams and charts will give you practical pointers on the various methods used for reducing and controlling costs. Others, are used to aid you in getting a better understanding of the principles involved in changing, setting up, or operating an industrial organization. In addition, the information is drawn from many sources so as to be of interest and benefit to those in most manufacturing and productive industries.

Of particular interest is the treatment given by the authors to product development, wage and salary administration, marketing, time and motion study, production control, inventory control, quality control, and cost control. All information on these topics is as complete and as up-to-date as possible.

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versity Extension, University of California, Los Angeles 24, Calif.

FEBRUARY 28-MARCH 1—Malleable Founders Society's Seventh Annual Technical and Operating Conference, to be held at the Hotel Pick-Carter, Cleveland, Ohio. For more detail, contact the society, 781 Union Commerce Bldg., Cleveland 14, Ohio.

Film on Solid Carbide Tools

A twenty-two-minute, 16-millimeter, sound-color movie film deal-

ing with the manufacture of solid carbide tools and burs has been produced by the Atrax Co., Newington, Conn. The film presents the company's precision grinding techniques. Shown are steps from carbide blank to finished tool, and then on to unusual job applications such as end-milling turbine buckets in high-tensile stainless steel. It is planned to make showings of "Solid Carbide Tools and Burs" available to carbide societies, cutting-tool groups, and industrial meetings, which can be arranged by contacting Peter Apostle, Atrax Co., Newington 11, Conn.

New Books

ROD, BAR AND WIRE PRODUCT INFORMATION—Second Edition. Prepared by the Technical Publications Department of Kaiser Aluminum & Chemical Sales, Inc. 388 pages; 5 1/2 by 8 1/2 inches; illustrated. Published by Kaiser Aluminum & Chemical Corporation, Kaiser Center, 300 Lakeside Drive, Oakland 12, Calif. Available without cost if requested on company letterhead; otherwise, price is \$7.50.

This revised product information book has been published to meet an increasing need for current data applicable to the rapidly expanding metalworking field where aluminum rod, bar, and wire are used. In addition to new alloy descriptions and product availabilities, the book presents more specific characteristics about standard alloys than the prior edition. It discusses in detail advanced fabrication techniques developed for a broad range of work.

Technical information covering metalworking methods, welding, mechanical joining, and finishing has been greatly expanded. Engineering tables, designed to simplify and speed reference work, are more comprehensive and easier to use. They are listed in a classified index.

Text material and illustrations are arranged for easy and interesting reading. A comprehensive table of contents, as well as a subject index, provides quick references to the subjects discussed. A glossary of terms and definitions common to rod, bar, and wire manufacture and application is included.

Similar in purpose to other Kaiser Aluminum technical publications, this new edition is offered to assist engineers, designers, production personnel, purchasing agents, and executives in the selection and use of aluminum.

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NUMERICAL CONTROL
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"HOLE HOG"
Machine Tools for—**

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Model HD68 Tube Sheet Drilling Machine with Multi-Numeric Numerical Control for positioning of machine table in two directions and for selection of spindles. Information on punched tape permits automatic drilling of a complete hole pattern in a tube sheet without interruption.

Model HU111 Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.

Model MR148 Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.

HD13 straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

60 years of Machine Tool Engineering Experience is at your service for

- Multi-Spindle Boring • Single and Multi-Spindle Honing
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Representatives in principal cities

Annual Index to Machinery

The annual index to Volume 67 of **MACHINERY** (September 1960 to August 1961, inclusive) is now ready for distribution. Readers who have not previously requested copies can obtain them without charge by writing to **MACHINERY**, Circulation Department, 93 Worth St., New York 13, N. Y.



An exclusive coaxial spindle design combined with a unique, beltless-type, mechanical variator drive unit (5 HP), enables the Micro-Turn Lathe to deliver constant horsepower throughout entire speed range, actually maintaining drive speed output within two-tenths of one percent. Built-in torque responsive mechanism positively prevents slippage even under starting or shock loads. Maximum torque is assured at low speeds for heavy cutting, with super-smooth operation at highest speeds for ultra-fine finish, all complemented by the Micro-Turn's rigid construction and supreme balance.

Features include:

- pushbutton control with direct reading tachometer
- spindle speed ranges changed by pushbutton . . . without stopping spindle
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- fail-safe pressure lubrication to headstock, gear box and end gearing
- pressure lubrication to carriage and cross slide ways provided by pump located in apron; one-shot plunger to lubricate cross slide ways when carriage is stationary
- choice of manual or automatic coolant operation
- hardened and ground leadscrew, cross feed screw and compound rest screw

For the complete, illustrated story on the revolutionary MICRO-TURN, write today for your copy of Bulletin No. 222. Nebel Machine Tool Corporation, Lathe Division, 110 S. Cooper Ave., Cincinnati 15, Ohio.

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MICRO-TURN*
HIGH SPEED PRECISION LATHE

Spindle Speeds

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Finish

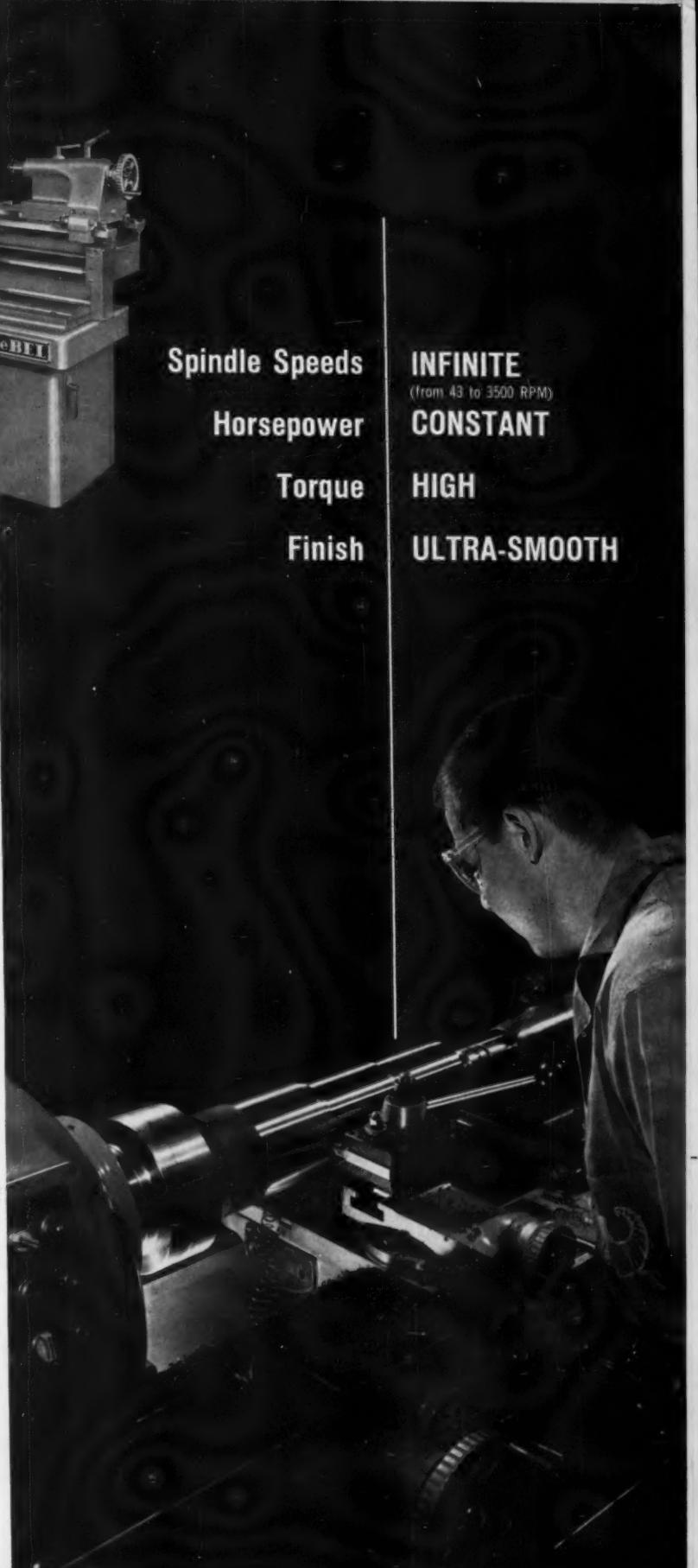
INFINITE

(from 43 to 3500 RPM)

CONSTANT

HIGH

ULTRA-SMOOTH



(This section continued from page 218)

"UNIVERSAL" HYDRAULIC COPYING ATTACHMENTS brought out by Cazeneuve Lathes, Inc., Linden, N.J., for Cazeneuve HB 500, HB 575, and HB 725 lathes. This unit is designed for both longitudinal and lateral copying. The slide-ways are chrome-plated to minimize wear and are automatically lubricated. Double guide-ways permit faceplate work with considerable overhang. A micrometer device allows a finishing cut to be taken immediately after the roughing operation, without removing or adjusting the template or tools.

Circle 633 on Readers' Service Card

RAM TYPE BENDING BRAKE FOR FLAT STOCK announced by Pines Engineering Co., Inc., Aurora, Ill. This machine is designed to form flat stock into a multitude of part shapes. It has a capacity for bending up to 1/4- by 2 3/4-inch cold-rolled steel and operates at speeds up to 50 cycles a minute. Built to rugged machine tool standards, the machine is powered by a self-contained 7 1/2-hp, 2000-psi hydraulic system, acting through toggles to provide greatly multiplied bending force for the ram. A pedestal type con-

trol station actuates the machine electrically, a foot-switch being provided to free both hands for fast work-piece handling.

Circle 634 on Readers' Service Card

AUTOMATIC COMBINATION SHEAR AND WELDER developed by Guild Metal Joining Equipment Co., Bedford, Ohio. This machine provides means for continuous feeding of strip stock of any thickness from 0.040 to 0.250 inch for roll-forming, tube-manufacturing, punch-press operation, and coil-strip processing lines. It automatically aligns the trailing end of a processed coil and the leading end of the new coil, clamps both ends, shears, sets the two ends at the proper gap for arc welding, and automatically welds the strips together with little or no increase in joint thickness over the parent metal. Complete time for clamping, shearing, and welding ranges from forty to sixty seconds, depending on material thickness and width. Any width stock from 2 to 17 inches can be processed on the machine.

Circle 635 on Readers' Service Card

MINIATURE END MILLS and combination drills and countersinks of high-speed steel announced by Quality Tool

Works, Waukegan, Ill. The end mills have uniform 3/16-inch shanks and range in size from 1/32 to 3/16 inch in diameter. They are designed for use in milling straight slots, grooves, or intricately shaped slots in dies, molds, tools, electrotypes, engravings, plastics, and plastic-metal laminates. The combination drills and countersinks are made in three sizes—0.020-, 0.025-, and 1/32-inch drill diameters. All have a body diameter of 1/8 inch.

Circle 636 on Readers' Service Card

SENSITIVE MICRO SWITCH of 22-ampere capacity, with operating characteristics said to be more sensitive than those of previously available high-capacity switches, has been announced by Minneapolis-Honeywell's Micro Switch Division, Freeport, Ill. This switch can handle up to 35-ampere inrush currents. Similar in construction to other precision micro switches, the new unit features a snap-acting beryllium-copper spring mechanism inside a molded phenolic case. Moving serrated silver contacts are said to produce high contact pressures, reduce contact resistance, cut through any films on the contacts, and more easily break any welds caused by overload.

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Fork truck sets palletized coils on bed of Cradle.



Cradle tips backward as base rotates.



Cradle nears end of 90° backward tip as it is finishing its 180° base rotation.



Coils, now off pallet, face truck and are ready to fork.

TURNOVER CRADLE PALLETIZES AND DE-PALLETIZES COILS IN SECONDS

In as little as 14 seconds, one man and a fork lift or crane can up-end and remove coils from pallets with the automatic Turnover Cradle. This labor-saving device does the job six times as efficiently as older methods. To palletize coils, simply reverse procedure. Won't damage material. Send for illustrated brochure.

turnover cradle

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Special and standard
PRECISION GEARS UP TO 200 DIAMETRAL PITCH
All Gears certified for Accuracy
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**MITSUBISHI
INNOCENTI
CWB**

milling boring and combined machine

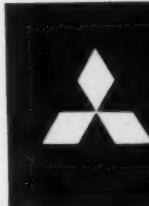
**Universality, productivity
and easy handling....**

are characteristics of INNOCENTI-CWB milling, boring and combined machine.

MITSUBISHI ZOSEN (Mitsubishi Shipbuilding & Engineering Company) manufacture and distribute the FA 140/95 type (dia. of spindle 140 mm for milling, and 95 mm for boring) of this universally-known machine, licensed by INNOCENTI S.G. of Milano.

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Machine tool manufacturing division

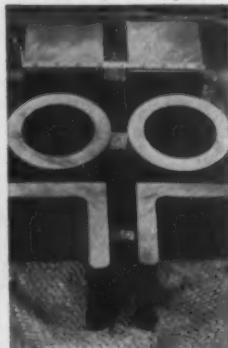
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Sole agent

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**WHAT'S YOUR SHOP COST PER
HOUR FOR WAGES AND OVERHEAD?**

If it's \$6.00 you spend 10 cents per minute.
If it's \$7.20 you spend 12 cents per minute.



**Cuts like these are
made in SECONDS!**

**\$6.00 per hour =
1/6 cents per second.**

**\$7.20 per hour =
1/5 cents per second.**

3 cuts - 6 finished ends.

**WHEN YOU CAN CUT AND
FINISH LIKE THIS (Total time 38 seconds) THAT'S
FAST! WHY DON'T YOU INVESTIGATE TO SEE WHAT
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Write and ask about "Cut-Machining."

WALLACE SUPPLIES MFG. COMPANY

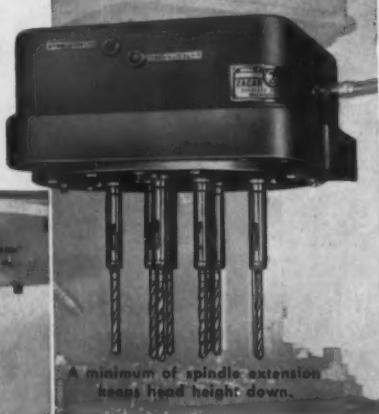
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Spindles
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ZAGAR
HEADS**

for
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reaming,
tapping

Spindle locations can be changed quickly, easily, on Zagar gearless heads. Rigidity is retained in a compact, low height head. Varying patterns can be economically machined with one head, adaptable to any standard drill press.

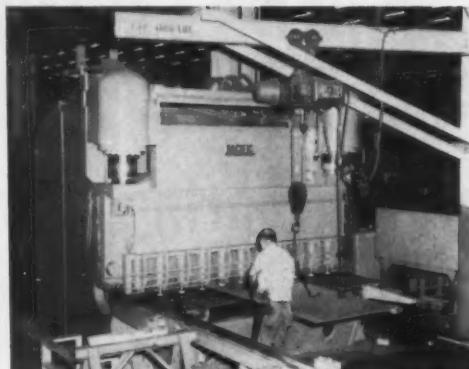


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Zagar INCORPORATED
USE MORE SPINDLES TO DO MORE WORK

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**HEAVY PLATE SHEAR CUTS LIGHT
METAL WITH MINIMUM BOW AND TWIST**



By a simple 1 minute adjustment, the rake angle of this massive $1\frac{1}{2}$ " shear at Caterpillar Tractor Co., Joliet, Ill., is set to cut thin sheet with minimum bow and twist. With similarly rapid adjustment of the knife clearance, the Pacific shear cuts a complete range of metals from light sheet to 1" plate to any accuracy of .030" over the entire 10 ft. bed length. Shorter pieces over 1" thick are cut to .125" accuracy. In any plant, large or small, an adjustable rake Pacific hydraulic shear replaces 2 or 3 conventional shears by cutting both light and heavy metals with equal accuracy, safety, speed.

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MACHINERY'S MATHEMATICAL TABLES

Edited by Holbrook L. Horton

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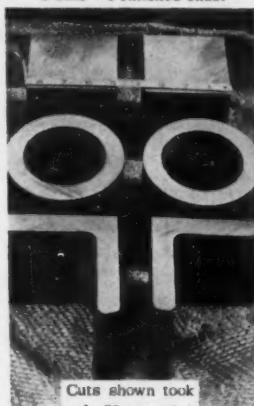
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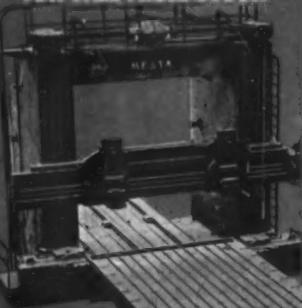
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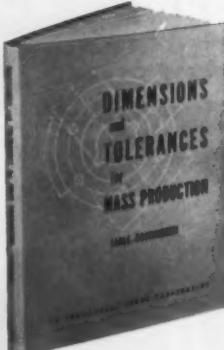
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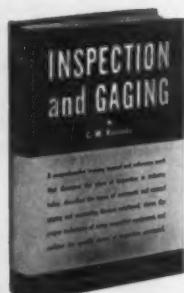
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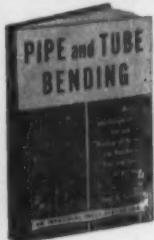
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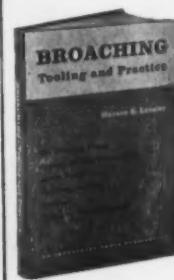
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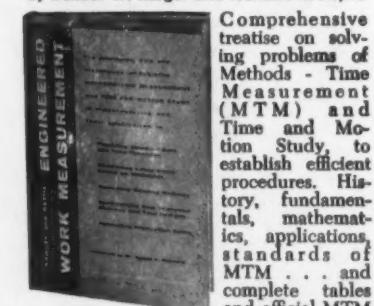
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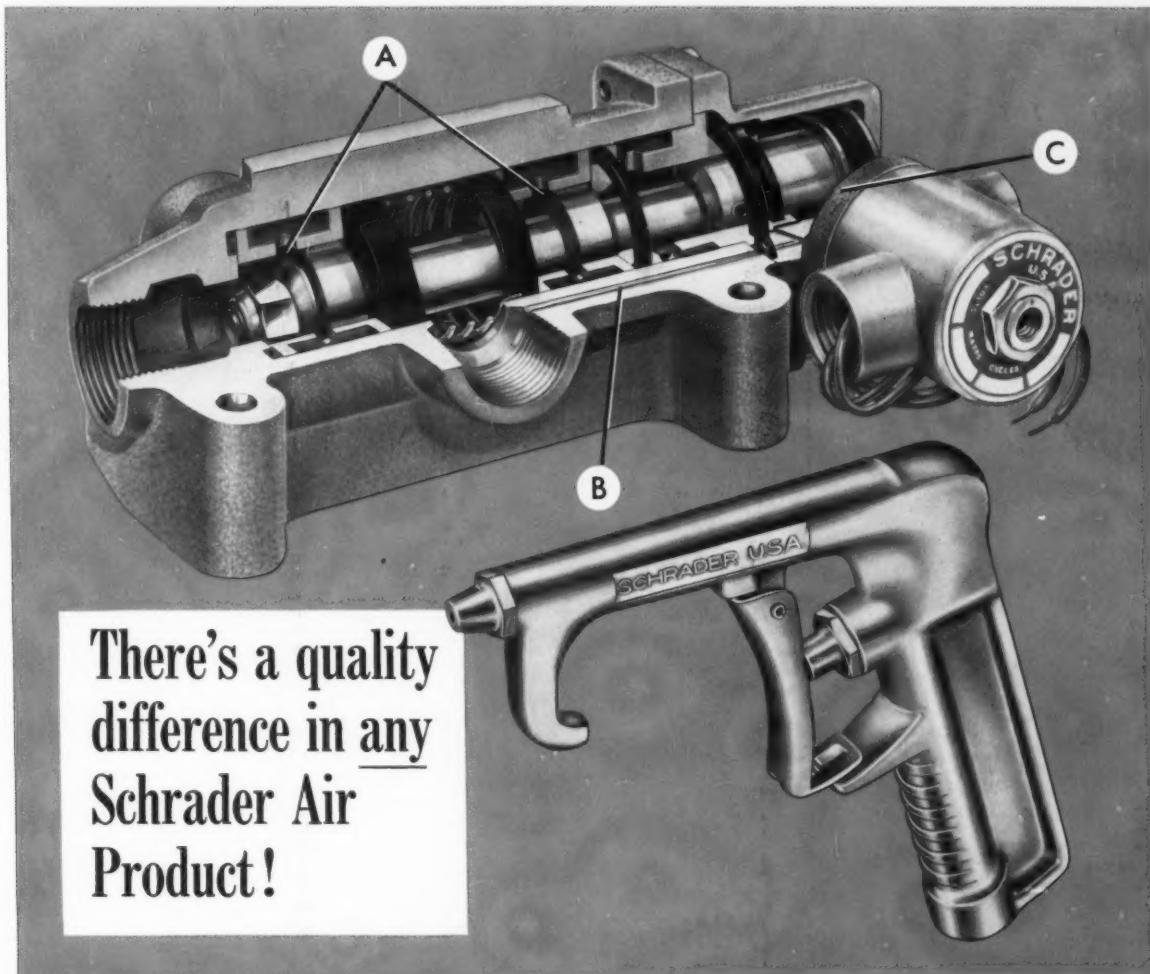
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